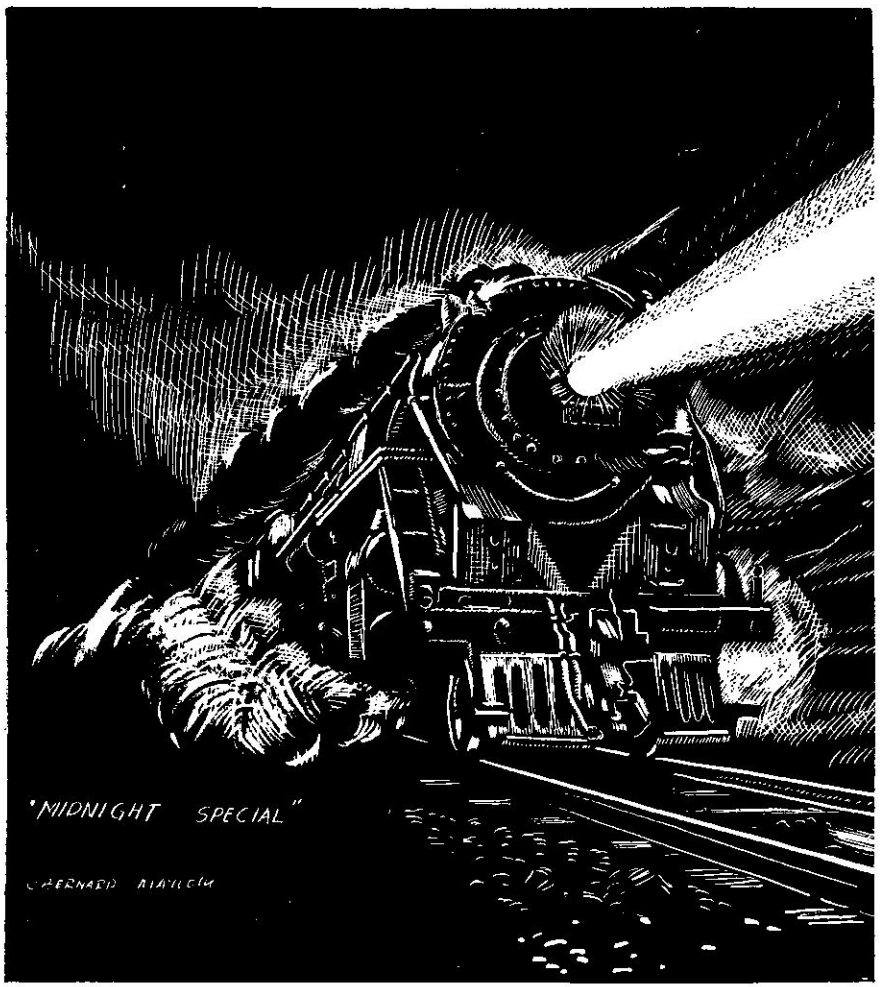
THE MODEL ENGINEER

Vol. 94 No. 2353 THURSDAY JUNE 13 1946 6d



An impression of an American express train rushing through the night. Reproduced from an original scraper-board sketch by Mr. C. B. Maycock

FALCON I 5 c.c. Engine
OF PHENOMENAL PERFORMANCE

Engine, complete with coil, condenser and plug, £6 10 0
Set of castings and materials, now £1 4 6
Crankshaft is *not* included in set of castings but is supplied ready machined, hardened, and ground 15 6

Special Notice

FALCON ENGINES and "1066" Car Parts, Coils, etc., Plugs, Nife Batteries will in future be marketed by "1066 PRODUCTS LTD." to whom all enquiries, orders, etc. should be addressed. No callers please. Send 3d. in stamps for list. Trade enquiries invited. No telephone—YET!

TEN-SIXTY-SIX PRODUCTS Ltd.
6, THE PANTILES, ELMERS END
BECKENHAM, KENT

CUT *in any direction*

Manufactured by the Inventor of Tension Files. Will cut the most intricate profile in the hardest metals; are flexible, not brittle, and have exceptionally long life.

Cut to Filemakers' Assn. Specification in Bastard, 2nd Cut and Smooth. Ideal for Toolmaking, Sheet metalwork, Model making, Radio, Plastics, etc.

To fit 9 in., 10 in., and 12 in. Hacksaw frames.

Prices: Files per doz.
9"—9/-, 10"—10/-,
12"—12/-
Links—4/6 doz. pairs

Trade enquiries invited.

—with "DAVIES" TENSION FILES

Of all stockists or direct from

ROSSLYN ENGINEERING SUPPLIES LTD.
Park House, Rosslyn Road, E. Twickenham, Middx.
'Phone: POPesgrove 2162.

SURPLUS MACHINE TOOLS FOR DISPOSAL

LATHES.—Crowthorne all-geared head, motorised, Gap-bed Lathe, **£165.** Ace 6-in. Tool-room Lathe, gap bed, chuck and steady, **£95.** Colchester "Master," gap-bed, S.C. Lathe, war finish, **£85.** Monarch 8-in. double-back-geared S.C. Lathe, Norton gearbox, **£85.** A.E.H. 4½-in. Precision Tool-room Lathe, 42-in. bed, **£80.** Lorch Precision Lathe, plain, **£40.** American Tool Works 6-in. S.C. Lathe, quick-change gearbox, **£40.** Southbend 4½-in. Precision Tool-room Lathe, motorised, **£95.** Southbend 4½-in. Precision Tool-room Lathe, quick-change gearbox, motorised, chucks, collets, **£115.** Britannia 6-in. Gap-bed Lathe, S.C., **£35.** Drummond 5-in. S.C. Lathe, motorised, 1½ h.p. motor, chuck, steady, **£57.** Atlas 5-in. motorised S.C. Lathe, on stand, **£65.** Sphere 5-in. S.C. Lathe, chucks and various equipment, motorised on stand, **£65.** Lang 10-in. Gap-bed Lathe, **£40.**

CAPSTANS.—Ward 2A all-geared Capstan, 1½-in. capacity, ball chuck, s.p.d., **£140.** Wards Nos. 2 and 3 1½ in. and 1½ in. capacity, roller bearing heads, power feed to turret, complete with motor drive, each **£85.** Ward, Herbert, Barden & Oliver, Archdale, Warner & Swasey, 1 in. to 2 in., each **£30.**

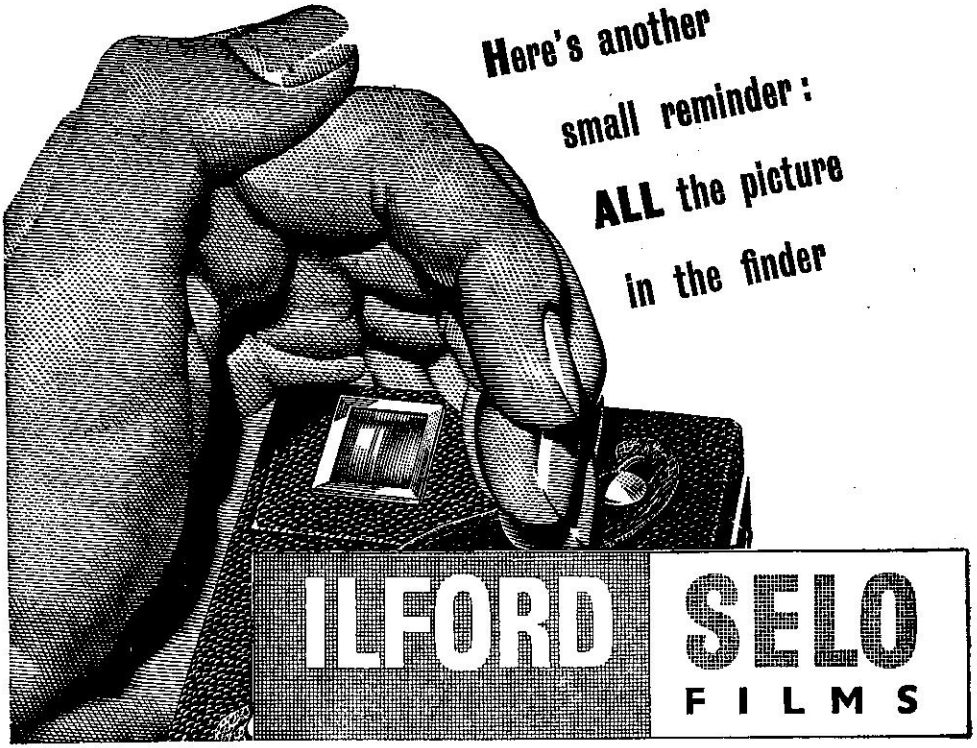
MILLING MACHINES.—Milwaukee all-geared single pulley drive, 48-in. table, **£150.** Pallas plain tool-room, 36-in. table, gearbox for feeds, **£95.** Becker 4B and 5B verticals, each **£75.** Weisser, Muller & Schuckhart light vertical Millers, each **£35.** Centac & Ajax, motorised, bench Milling Machines, as new, each **£45.**

POWER SAWS.—Swiftcut, Speedax, Acme, Orian, and Manchester Rapidor, **£10** to **£62.**

GRINDERS.—Schutte Oilmatic, surface and tool and cutter grinder, motorised, **£210.** Brown & Sharpe No. 2 Surface Grinder, **£100.** Capco motorised, Surface Grinder, hand-operated, **£87.** Brown & Sharpe No. 1 Universal Cylindrical Grinder, 18 by 6 in., **£125.**

60 other machines. List free. Machines may be inspected any time, including week-ends.

VICTA ENGINEERING COMPANY,
MAIDENHEAD — BERKSHIRE
'PHONE 50.



FMF

IMPORTANT
ANNOUNCEMENT
TO USERS OF

SOLDER

Ministry of Supply Authority now permits us to supply pre-war tin rich solders without permit or licence. Solders containing 50% tin and 60% tin and over are now freely available from stock. Samples and prices will gladly be sent on request.

Tinman's Solder — *Cored Solder Wire*
Blowpipe Solder — *Solder Tape and Strip*
Solid Solder Wire — *Solder Rings and Washers*
Solder Paint

FRY'S METAL FOUNDRIES LTD
Tandem Works, Merton Abbey, London, SW19
and at Manchester, Bristol, Glasgow and Dublin

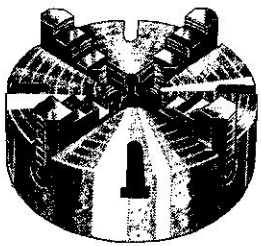
There is no substitute for

'Plasticine'

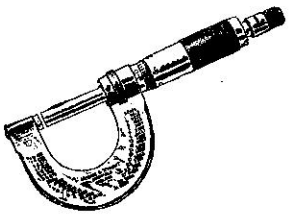
THE WORLD'S FOREMOST
MODELLING MATERIAL
WITH A 101 USES
IN HOME, SCHOOL,
STUDIO AND WORKSHOP

HARBUTT'S PLASTICINE

Beware of imitations. Genuine "Plasticine" is made only by
H A R B U T T S



INTRODUCING OUR FIRST NEWSLETTER



MYFORD LATHES. We are now accepting orders for the new ML7 and M 3½". Delivery dates are extended ; full specifications on request.

THE FOLLOWING ARE OFFERED FOR IMMEDIATE DELIVERY

VERTICAL SLIDES. Model MA67/1. Slide for table, machined integral with rigid angle-plate. Feedscrew 10 t.p.i. Acme form, with micrometer dial graduated in 0.001 divisions. **Price £2 5s.,** plus 15 per cent. The new swivelling model (MA68/1) will be available shortly. **Price £3 15s.,** plus 15 per cent.

BENCH LEVER SHEARS for hand operation. Three models : No. 1. (⅜-in. rounds, 5/32-in. strips, ¼-in. sheets), **52s. 6d.** No. 2 (7/16-in. R., ⅜-in. S., 5/32-in. S.), **64s. 6d.** No. 3 (½-in. R., ½-in. S., ⅜-in. S.), **97s. 6d.**

LATHE COUNTERSHAFTS. Power Model, 4 in. by 1 in. fast and loose pulleys on substantial hangers. **Price £2 2s. 6d.,** plus 15 per cent. Ditto, with 8-in. pulleys. **Price £3,** plus 15 per cent. **Motor Type,** with long shaft for grinder-pulley. **Price £2 2s. 6d.,** plus 15 per cent. **Bench Model, £2 2s. 6d.,** plus 15 per cent. MYFORD Bench Motor Units (less motor), Vee, **£4 5s.** ; Flat, **£3 17s. 6d.,** both plus 15 per cent.

MYFORD SERVICE. We are always happy to sell **quality** products. For this reason we are particularly keen to maintain our excellent service of MYFORD accessories and replacements. Accessory leaflet on request.

SIFBRONZE SERVICE. Complete stocks of all "Sif" rods and fluxes.

TAPS, DIES and TWIST DRILLS. We distribute only the finest quality. Full user's terms.

SIFCUPRON. A copper-alloy rod of low melting point (750 deg. C.) for brazing brass and copper. Self-fluxing, these rods can be used economically, replacing silver solders. **Price 5s.** pkt.

POWER GRINDERS. De-luxe Two-wheel 6-in. Bench Grinder, with detachable covers, tool-rests, 1/3 h.p., 2,800 r.p.m. Motor, 230 V. a.c. only. Spindles run in ball-bearings, **£10 15s.** Strictly limited supply, ask for pro-forma invoice before remitting.

CROWN LATHE CHUCKS. Independent four-jaw, 4-in., **36s. 6d.**, 6-in., **62s. 6d.** Scroll Gear, three-jaw, 4-in., **£3 12s. 6d.**, 6½-in., **£4 12s. 6d.** Back-plates can be fitted at extra charge.

HI-DUTY VICES. 3-in. Plain Model, **17s. 9d.** 4½-in. Quick Release, **56s. 6d.** Both plus 20 per cent. increase.

LIVE LATHE CENTRE. No. 2 Standard Duty with No. 2 MT Shank only, **£3 16s.**

COLLET CHUCK SET. Chuck and Set (9) Collets, No. 2 MT, fitting as recently advertised, **£7 7s. 6d.** Smartly boxed.

TYPHOON MACHINE VICE. A welcome revival of a favourite tool. Body of cast-iron, jaws of hardened steel. Two vertical sides of body machined at 90 deg. to base, swivelling angle-plate fitted to jaws. Width of jaws, 2⅜ in. ; opens 2⅝ in. **Price £1 3s. 6d.**

LATHE CENTRES. Plain, No. 1 MT, **3s.** No. 2 MT, **4s. 6d.** Wood Prong, No. 1 MT, **6s. 6d.** No. 2 MT, **6s. 6d.** Square or Fluted (No. 1 MT only) **5s.** Hollow, **3s.** Add 15 per cent. increase to all prices.

TAP and DIE SETS. We shall be pleased to quote for your requirements in smart boxed sets of Taps and Dies. Full user's terms.

WELDING OUTFIT. We can now offer reasonable delivery on our No. 22 Oxy-Acetylene Welding Outfit at **£12 12s.** Details on request.

MOORE & WRIGHT TOOLS. We are pleased to offer this famous range of tools and precision instruments. Quotations for your requirements sent gladly on request.

PRECISION DRILL CHUCKS. Jacob's pattern, 0-½-in., **16s.**, 0-⅝-in., **20s.** No. 1 M.T. Arbors, **3s.** extra.

BURNERD LATHE CHUCKS of quality. Four-jaw Independent, 3½-in., **39s. 6d.** ; 4-in., **41s.** ; 4½-in., **49s.** ; 6-in. **77s. 6d.** Three-jaw S.C. : 2½-in., **78s. 9d.** ; 3-in., **63s.** ; 4-in., **97s. 9d.** ; 6-in., **165s. 6d.** Add 15 per cent. increase to all Burnerd prices. Back-plates can be fitted at extra charge.

TWIST-DRILL SETS. Set of H.S. Drills with Stand, 1/16-in.-½-in. by 1/64-in., **67s. 6d.** Nos. 1-60, **59s. 9d.** Stands only, fractional or Wire Gauge, **2s. 6d.**

LIGHT TURNING SERVICE. Our light engineering shop is now back in full production and we invite orders for lathe chuck back-plates, etc. Excellent workmanship in all branches of light engineering. Special order forms on request.

M.E. EXHIBITION AUG. 22-31st

IN BRIEF. Blowlamps, Pint Paraffin, **27s. 6d.** and **30s.** Backplate Castings, all sizes. Five-step (1⅞-in., 2¾-in., 3 21/22-in., 4 11/16-in., 5 5/16-in.) Zinc-alloy Vee Pulleys, ½-in. or ⅝-in. bore, **6s. 6d.** Carbon Drill Set, 1/16-in.-½-in. by 32's, **5s. 9d.** Boxes Assorted Silver Steel, Round, **5s. 6d.** ; Square, **8s. 9d.**, and everything for the Engineer. Send us your problems and enjoy our friendly service.

Carriage extra.

STAND Nos. 5 & 7

GARNERS, Sheffield Road, BARNSLEY

Phone 2866 (P.B.E.)

THE
MODEL ENGINEER
Percival Marshall & Co. Ltd., 23, Great Queen Street, London, W.C.2
VOL. 94. No. 2353. JUNE 13th, 1946

Atomic Power

BEING in a speculative frame of mind, it was, perhaps, not surprising that my thoughts on a recent occasion should turn in the direction of atomic power. What does this remarkable release of the energy of the atom forecast for the world in general, and for model engineers in particular? Leaving aside the destructive possibilities of the atomic bomb, terrible enough to contemplate in all conscience, what are the industrial probabilities of the harnessing and useful application of the enormous power latent in the minute, but certainly mighty, atom? For years past scientists have been predicting that once the atom could be split a truly amazing release of energy would result. The laboratory problem has been solved, the theories have been verified, and now the scientific world is busy trying to evolve ways and means of turning this new source of power to the beneficent needs of humanity. Various writers and speakers have been glibly predicting the propulsion of the *Queen Mary* across the Atlantic with a "thimbleful of atomic energy," or the operation of a turbine with the power derived from a small heap of uranium alongside. With a similarly loose imagination, I might picture model locomotives being driven by a pinch of uranium dropped in the firebox, or model speed boats racing round the pole at 100 m.p.h. with a whiff of vapour from a uranium smelling-bottle. This, of course, is sheer nonsense. The truth is that the man in the street, like myself, knows little or nothing about it, and can only form somewhat fantastic guesses on the very limited knowledge at present available to the public. A modern Jules Verne might visualise something more practical, as he did about other scientific discoveries, in his remarkable books. The scientists now engaged on atomic research are possibly beginning to see a little daylight through the problem, but years must elapse before atomic power becomes an everyday servant of humanity. The heat energy stored in coal has displaced laborious hand power, petrol is now steadily ousting coal, will petrol give place to the atom? Try to imagine how you would apply the explosion of a stick of dynamite to the operation of a turbine or a reciprocating motor, and you will have a faint idea of the difficulty of applying atomic energy to the driving of industrial machinery. The disruption of the atom produces both intense heat and intense pressure. Whether either or both of these manifestations of energy can be harnessed in the service of man will require prolonged and costly experiments. The day of the introduction of atomic energy into model engineering is not yet, but meanwhile we can watch the progress of the scientists with much interest, and possibly with anticipation of new opportunities for applying our model making skill.

Left-handed Scissors

AS a tail-piece to our recent symposium on left-handed mechanics, Mr. C. H. Clarke writes :—"Perhaps the most striking instance of the necessity for a specially-made left-hand tool is in the case of scissors. The normal method of using these is impossible, even for a left-handed person, since the action of the fingers, with the right hand, is to hold the blades together, whilst with the left hand it forces them apart, so that they do not shear, unless they are inconveniently tight. Yet there is no such thing on the market, even for nail-scissors, which must be used in the left hand by all right-handed people. It is interesting to note that I once came across an official ruling that left-handed scissors do not constitute an invention."

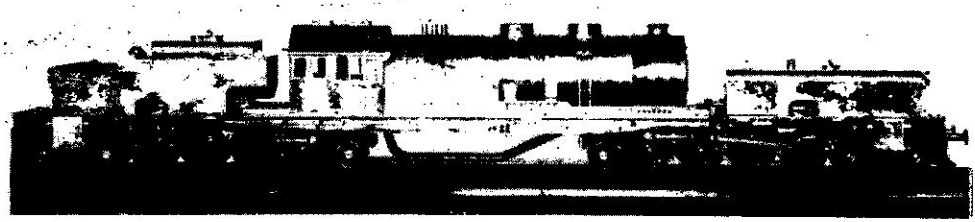
A Noah's Ark Model Competition

AN interesting competition for model makers is proposed by the Shipwrights Company in connection with their forthcoming nautical exhibition to be held in London early next year. They are offering prizes of £100, £50, and £25 for the three best models of Noah's Ark based on the information given in the Book of Genesis, chapters six and seven. Noah's Ark may not have been the first vessel to go afloat, but it could certainly be regarded as the first passenger liner of which there is any record. This competition affords an interesting opportunity for some careful research.

Percival Marshall

Model LOCOMOTIVE PROGRESS

J C Crebbin 1945



Mr. Glanville's 4-8-2-2-8-4 (¾-*scale model*) *Garratt locomotive*

IN spite of my years, I am still proud to be considered a model and experimental engineer. It is still my ambition to encourage the joining together of all who are interested in the subject, forming more friendships, and cheering the lone hand in his efforts.

The progress of model engineering has been most marked during recent years. The workmanship has improved so much that I am sure such great model engineers as the brothers Coates, Dr. J. Bradbury Winter, the late Mr. E. L. Palmer, among others, would have been delighted had such work been turned out in their day. I might add here that it is very cheering to read articles again, from the pen of Dr. Bradbury Winter.

Correspondents have asked if the model 2-8-0-0-8-2 I am reconstructing is the most powerful 3½-in. gauge locomotive. My reply is that it is not! It has been surpassed by at least two model locomotives in 1945.

The outstanding model, for this gauge, as far as I know, is a working model of a Beyer-Garratt 4-8-2-2-8-4 locomotive, built by Messrs. Beyer Peacock for the Iranian Railways. The model, ¾-in. scale, has been built under great difficulty in Teheran by a member of the London S.M.E.E., Mr. P. R. Glanville, and the following are the principal dimensions :—Length over buffers, 6 ft. ¾ in. ; height from rail level, 10⅝ in. ; width, 8⅝ in. ; number of cylinders, four, all high-pressure, 1 5/16 in. diameter by 1⅝ in. stroke ; coupled wheels, 3 5/16 in. diameter ; bogie and trailing wheels, 1¾ in. diameter.

The boiler is made from copper sheet ⅛ in. and 1/16 in. thick. The barrel was rolled and joined together with a riveted butt-strap, which is also brazed. The flues are of fairly thick copper tube turned down between the tube-plates leaving ½ in. at each end of the original thickness for brazing in place.

The boiler is fed by two Linden injectors, the working pressure being 80 lb. per sq. in. The approximate weight of the engine without coal and water is 3 cwt. and the minimum radius traversible 14 ft.

Mr. Glanville, after witnessing the satisfactory working of the simple vacuum-brake system adopted by Mr. E. J. Linden, on his L.M.S. Pacific locomotive and trucks, decided to fit the system to the brake-gear of his Mastodon.

In order that trials of this locomotive and the 2-8-0-0-8-2 Mallet compound may be carried out during 1946, Mr. McCall, of Gerrard's Cross, is kindly fitting an extra rail to his experimental continuous track.

Mr. McCall is the builder of two fine 1-in. scale tank locomotives. One is a 4-6-2 having two inside cylinders, with Joy's valve motion ; the other, a 4-6-4 with four cylinders and Walschaerts valve motion. He also designed and built an ingenious stand by means of which each locomotive can be turned over for oiling and cleaning.

It is hoped that all these interesting engines will be on view at the next MODEL ENGINEER Exhibition.

In South Africa, some remarkable model locomotives are under construction. The outstanding one is undoubtedly Mr. Rowbottom's 3½-in. gauge, 1-in. scale 4-6-2 Class " 10 BR " of the South African Railways. The cylinders are 1⅝ in. diameter and 2⅜ in. stroke, and are fitted with large piston-valves, ⅞ in. diameter.

The regulator is on the superheated side of the steam, and compensating spring gear is fitted to the coupled-wheel axle-boxes, a practice greatly to be commended.

Steam reverse is being fitted ; also a turbo-generator. The latter is completed and, on test, was a complete success. The success of the sight-feed lubricator will be awaited with interest.

The boiler is modern in design, the firebox being fitted with two ½-in. diameter thermic siphons and plenty of water-space round the sides.

Trouble may be experienced from priming, due to the safety-valves being fitted over the 1-in. water-tube struts ; but the steaming capability of the boiler should be excellent.

Mr. Rowbottom is greatly to be commended on the design, and, knowing of his fine workmanship, I look forward to viewing the engine when it is completed.

Another fine model 5-in. gauge engine is being built by Mr. W. C. Henning, of Johannesburg. This is a 1-in. scale 4-4-2 London, Tilbury & Southend Railway 4-4-2 tank locomotive.

Model locomotive built in Oxford Street by the father of the late Sir Henry Wood

Mr. Henning was at one time employed in the works of this company, hence his interest in this type. The valve-gear gives a long travel and is of similar design to that suggested by the late Mr. G. S. Willoughby in one of the best articles on valve-gears which has ever appeared in the pages of THE MODEL ENGINEER.

I do not think a combustion chamber is necessary in so small a boiler. Mr. Henning has now decided upon one of the standard type having ½-in. flues; also, an iron arch in the firebox, similar to the method adopted by Mr. McCall. The arch is kept in place by a bolt which passes through a small tube serving as a stay in the front section of the firebox. Thus, the arch is easily removed.

Mr. Crebbin's new tender for his 4-8-0 compound locomotive

Another high-class South African model engineer, Mr. George Perrem, is constructing a fine specimen of the 1-in. scale "Midge," the contractor's engine designed by Mr. Gentry in THE MODEL ENGINEER.

On the other side of the Atlantic, our old friend, Mr. D. W. Massie, has under construction a 3½-in. gauge 4-6-6-4 tender express locomotive, which should give a good account of itself when completed.

It is gratifying to note the interest being taken in the construction of some "old-timers," perhaps the most notable being a ¾-in. scale model of one of Allan's early 2-4-0 goods engines having outside cylinders and built for the old L. & N.W.R.

It was recently constructed by Mr. D. H. Harris and won the Graham prize at the A.G.M. of the Society of Model and Experimental Engineers for 1945. A really fine piece of work.

Mr. Pinnock, the present popular chairman of the Society, is constructing an early contractor's tank engine, and Mr. K. N. Harris has in hand a ¾-in. scale model of the G.W.R broad gauge *North Star*.

"L.B.S.C." has also encouraged the construction of early locomotive types, and I have been privileged to see some excellent examples of workmanship of some of these engines under construction, notably, several of the 2-4-0 Great Eastern Railway, designed by the late Mr. James Holden. It is interesting to note that many of these models are being built by beginners.

The remnants of an early 3½-in. gauge model belonging to Mr. Peter Jeffree recently came to my notice. What interested me was the fact that it had been built by the late Sir Henry Wood's father, Mr. H. J. Wood, of 185, Oxford Street, London.

I undertook to reconstruct it as near to its original condition as possible, so that I could have the pleasure of seeing one of these glorified toys of 1875-1880 under its own steam.

The model had to be overhauled and many parts reconstructed, including new valves, piston-rods, etc.; I was very surprised to find that Mr. Wood believed in large ports and port areas. Launch-type link-motion also was adopted.

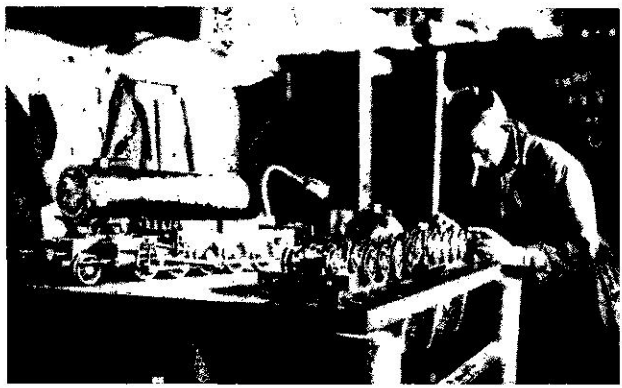
New steam and exhaust piping had to be fitted; a blast pipe, a new chimney and the smokebox made air-tight.

The boiler is of the locomotive-type and made of thin copper. Many leaks had to be stopped and a new safety-valve provided; but finally, all was ready for a test.

Like all early models, it is fired by a methylated-spirit lamp.

In testing it was found that, owing to the high position of the firebox in the barrel and having no dome, priming was rather bad. A superheater was not added, because the model would then not

Mr. Glanville constructing his Beyer-Garratt locomotive. Major J. W. Lawson's 2-10-0 in background



have been as originally constructed. Details of dimensions are as follow :—

Driving wheels (unsprung), 4 in. diameter. Bogie and trailing wheels, 2½ in. diameter. Bogie centre to driving-wheel centre, 6⅜ in. Driving-wheel centre to trailing-wheel centre, 4 in. Length over buffers, 17 in. Cylinders, ¾ in. bore by 1 in. stroke. Connecting-rod centres, 3½ in. Boiler total length, 10¼ in. Smokebox total length, 1⅜ in. Firebox length, 3¼ in. ; width, 2⅜ in. Barrel diameter, outside, 3¼ in. ; length, 6⅜ in. Five flues, ⅜ in. diameter ; 6⅞ in. long. Height from rail, 9¼ in. Tender : wheels, diameter, 2⅛ in. ; distance between centres, 3¾ in. Screw brake-gear, but no water-tank.

In watching the engine running on my track one could not help but conjure up the pleasure which it must have given to some interested folk of the past.

As far as my own models are concerned, when opportunity has occurred they have been overhauled and in some cases, reconstructed.

Sir Felix Pole, the 4-cylinder 4-8-0 compound, has had new high-pressure cylinders fitted and rings to the pistons.

When reboring the original cylinders, blow-holes appeared ; hence the necessity for reconstruction. Valve-gear has been rebuilt with a longer valve travel, and a bogie with a longer wheelbase is now fitted. The boiler has likewise been greatly improved with a larger and freer superheater.

A new tender has likewise been built, somewhat on the lines of the L.M.S.

A tip which may interest readers, and one which I also adopted successfully in the tender of the Mallet, is the method for observing whether the pump is working properly. The overflow surplus from the water-pump is taken through the tender and impinges against a small glass-covered man-hole on the top of the tank.

With regard to recent smokebox experiments, I have found that a 3-nozzle exhaust gives me the best results on " Milne," and I intend to carry out similar experiments on the other models.

Regarding " Milne " (4-6-0), the present chimney is 1⅛ in. inside diameter and each exhaust-nozzle is ⅛ in. I recommend other model engineers to try this experiment.

Of course, I know that the soft blast, with its economic working, is not popular with the crowd, who love a noisy exhaust, sparks and smoke, which accounts for the unpopularity of the model compound locomotive ; but, to the experimental engineer, the quiet and efficient running of his creation, gives a sense of satisfaction which must be experienced to be appreciated.

Another improvement has been to make the port passages, from port-face to cylinder-ends, as large and as smooth as is possible, for this reduces the friction of the exhaust steam. Steam enters the cylinder at a high pressure, but leaves it at a low pressure ; therefore, the passages should be as large and as smooth as is possible, to facilitate the passing of the exhaust steam. That is what the late Mr. G. J. Churchward had in mind when he remarked that it took a wise man to get rid of the exhaust steam ; in other words, design your cylinders from the exhaust side and the steam side will look after itself.

The late Mr. David Joy (of Joy's valve-gear fame) had the same idea in his mind when he designed the famous 2-2-2, *Jenny Lind* ; incidentally, one of the most successful locomotives of that period.

He not only made the steam passages as large as was possible, but he made them smooth by means of file and emery-paper.

To enlarge port areas which have been drilled, plug the holes with brass rod and drill out the fins between the holes, taking care not to interfere with the bolt-holes which are used to keep the covers in place.

Correspondents often ask me questions concerning lead. I cannot give a better answer than one made by the late Professor Edouard Sauvage to Mr. Churchward in my presence ; viz., " Shorter the lead, quicker the start." This practice is amply proved in the 2-cylinder 4-6-0 locomotives of the G.W.R. I can honestly state that I have never seen one of these engines have to reverse before getting away with its load.

In setting a valve worked by Stephenson's launch-type link, I put the reversing-lever in the first notch from full gear, and set the valve so that, when the piston is at the end of each stroke, the steam port is only about half a thousandth of an inch open. With Joy's or Walschaert's I arrange the same opening, but in full gear. The reason for this is that, in Stephenson's gear, the advance is variable ; but in the other gears the lead is practically constant.

Some model engineers think that the success of their models is due to the high piston speed obtained ; this is a fallacy, for most model locomotives have a very low piston speed when compared with the prototype.

Mr. O. V. Bulleid, C.M.E. of the Southern Railway, in a recent address, spoke of piston speeds of 2,000 feet per minute. How miserably our models fail in comparison with that figure. My own personal experience of model piston speed was when " Milne," driven by Major T. W. Lawson, reached 20 miles per hour. The driving wheels are 4⅞ in., and the stroke of cylinders 1¾ in.

The bugbear of the experimental model locomotive builder and driver, is condensation, and no matter what superheat is obtained, it is not sufficient to eradicate fully the trouble. Mr. G. J. Churchward arranged a superheater so that the exhaust steam temperature was the same as that of the boiler. Modern C.M.Es. provide for much greater superheat, which they find gives greater economy.

However, if the model locomotive builder achieves Mr. Churchward's results, then he will have attained success. Still larger superheaters should be fitted. My endeavours have been with firebox superheaters ; but I would suggest that further development be carried out even to this system.

An interesting boiler experiment is being carried out by Mr. Levick Johnson, of the S.M.E., who is fitting a ¾-in. scale " Royal Scot " firebox with a Nicholson thermic siphon and, also, a soot-blower. It is intended to carry out careful experiments with this boiler against a similar one without the additions.

(*Continued on page* 577)

★ Petrol Engine Topics

"CARVING OUT" A TWO-STROKE ENGINE

by Edgar T. Westbury

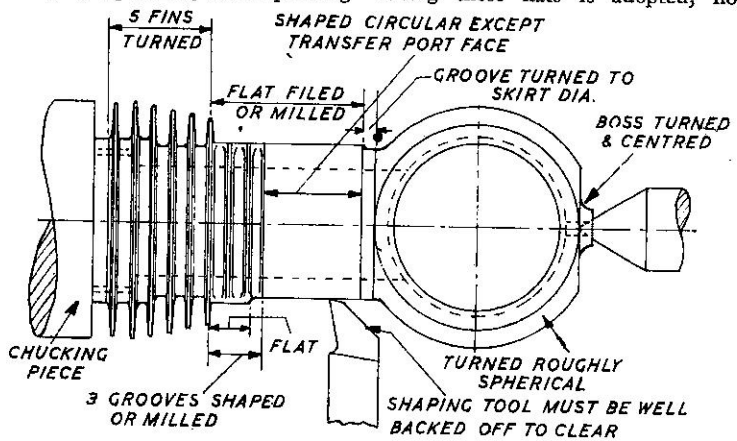
HAVING completed the straightforward machining on the body, a good deal of the superfluous metal, such as the corners of the crankcase, may now be cut away by any convenient method. It will be a good policy to provide a means of holding the job in the lathe so that it will turn about the cylinder axis, the most convenient way being to make a screwed plug to fit the thread at the top end of the cylinder barrel. If desired, this plug may be used to serve later as the cylinder head, but there are advantages in having a special plug which can be used at any time for chucking the body in this way.

When the work is held in the lathe by this means, it will be desirable to support the outer end by centre-drilling it and running up the tailstock centre to it. The small hole in the base of the crankcase may possibly be objected to by some constructors, but, if desired, an extra length of metal may be left to enable the centre to be cut away after its purpose has been served. But the presence of the small hole in the crankcase is no disadvantage, and it may be an asset in certain circumstances, being utilised to serve as a drain plug in cases where the engine is installed in an upright position, or as a priming plug when it is run inverted. After using it as a centre, it is drilled and tapped 6-B.A. to take an ordinary cheese-head screw $\frac{1}{8}$ in. long (it must not be longer, or it will foul the big end) or a more elaborate form of closure may be fitted at the constructor's discretion.

*Continued from page 530, "M.E.," May 30, 1946.

The end face of the body may now be turned to form the seating boss of the plug, after which a good deal of the superfluous metal around the crankcase may be roughed away by turning it more or less spherical. Care must be taken not to cut too deeply at any point so as to mar the joint faces; it would be advisable to mark a "witness" circle 1 3/32 in. diameter on each of these faces with a point tool, while the work is set up for the operation of crankcase machining as described previously, to serve as a guide in shaping the outside of the crankcase.

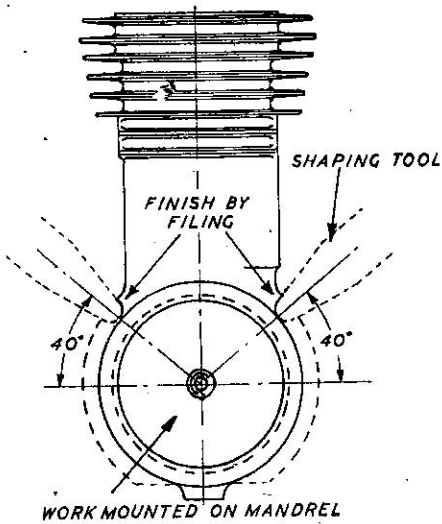
Next the flat faces for the exhaust and transfer ports should be formed by milling, shaping or filing, according to the facilities available. I have stated that this work can be carried out without elaborate equipment, which is perfectly true, but there is no doubt that some means of milling these faces, and afterwards, the ports, is extremely useful. End milling, with the work held on a vertical slide, and the cutter in the lathe chuck, is a very convenient method, and as a vertical slide is one of the most versatile, and also one of the least elaborate, fittings to facilitate milling, I imagine that many constructors will possess one. Whatever method of facing these flats is adopted, however, they should both be kept quite square with the crankcase end faces, and the exhaust port face should be cut only just deep enough to provide the required width of flat.


5 FINS TURNED
SHAPED CIRCULAR EXCEPT TRANSFER PORT FACE
GROOVE TURNED TO SKIRT DIA.
FLAT FILED OR MILLED
BOSS TURNED & CENTRED
CHUCKING PIECE
FLAT
3 GROOVES SHAPED OR MILLED
TURNED ROUGHLY SPHERICAL
SHAPING TOOL MUST BE WELL BACKED OFF TO CLEAR

Machining operations on engine body
(turning operations are carried out first)

The body is now replaced on the chucking piece, and supported by the back centre, for shaping operations around the cylinder barrel. First of all, the two bottom fins may be cut,

using the same tools as were used for turning the upper fins, providing they have plenty of front clearance. The method adopted in my own case was to attach a lever to the chuck by means of two of its backplate bolts, enabling the work to be turned by hand for a portion of a turn. To avoid the risk of accident, should it



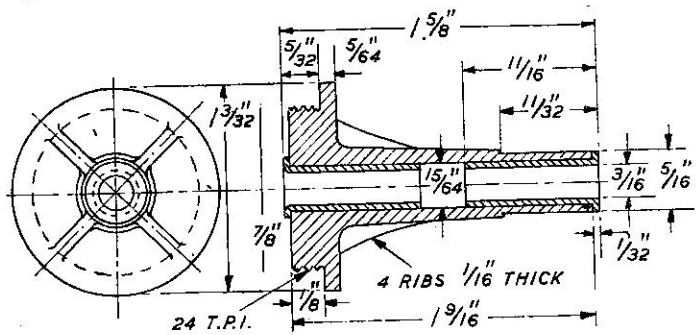
Shaping operation on crankcase barrel showing angular limits of the cut

overrun the intended limit of motion, it is advisable to fit a stop, which may consist of a block of hardwood clamped to the lathe bed by a suitable tee bolt, and located so as to abut against one of the chuck jaws at the limit of its travel. The tool should be engaged while the work is in motion, using the index to gauge the depth of cut, and withdrawn towards the end of the cut (as in "running-out" the end of a thread); unless this is done, the chip will pile up in the cut and cause trouble. Three cuts should be taken, the lower one forming the underside of the bottom fin, and the exhaust port face, and also a clearance for the longitudinal cuts which must be taken to remove the metal at the sides of the cylinder skirt. An alternative method of forming these grooves is by milling with a suitably shaped fly-cutter.

Much of the metal around the cylinder skirt can be removed by filing or straightforward milling, leaving the section of the skirt approximately square. It is now shaped by using a rigid round-nosed tool backed off well behind the cutting edge, lying on its side in the tool-post, with the centre of the nose at lathe centre height, and rocking the lathe saddle backwards and forwards, while indexing the lathe mandrel round a little at a time between each cut. My lathe is equipped with a simple indexing attachment, employing any of the change wheels on the lathe mandrel, in conjunction with a spring plunger mounted on the change wheel quadrant, which facilitates work of this nature. It will be found necessary to clamp the tool very securely and to avoid the temptation to take heavy "hogging" cuts, which only have the effect of causing the tool to shift and dig in. A stop, fitted to the lathe bed in much the same way as before, but in this case limiting the motion of the saddle, will prevent the risk of running into the bottom fin, or the exhaust port face. With due care and patience, quite a good finish can be obtained on the work by this method, and accuracy is beyond question.

The body can now be mounted by the crankcase barrel on its screwed mandrel, which is then placed between centres, and a similar shaping operation performed on the outside of the crankcase. It should be noted that the cylindrical portion of the barrel extends only to 40 degrees above the horizontal centre line on either side, where it blends into the cylindrical section of the cylinder skirt, so that care must be taken not to undercut this, which would not only be most unsightly, but would also seriously weaken the body at a point where strength is important. Around the point of intersection, a certain amount of metal will inevitably be left which cannot readily be dealt with by shaping methods, and this can best be dealt with by hand filing, the points to be observed being avoidance of undercutting or sharp corners. A good radius should be left at the junction of the curves, which will, of course, sweep downwards at the sides, and the best tool to use is a round file not less than ¼ in. diameter, finishing with a fine-cut half-round file and emery cloth.

The remaining machine work on the body consists of cutting the slots for the ports, which can best be done by the aid of end mills and the vertical slide, though drilling and filing is quite practicable. It will be seen that in each case the width of the port is in odd sixty-fourths, which may make it difficult to use standard cutters; but it is quite an easy matter to make special cutters from silver steel. The single-edged cutters described some time ago, by Mr. J. Latta—practically modified D-bits—are excellent for this work. They should be made with shanks not less than ¼ in. diameter,



Main bearing housing, with bushes in situ

and the reduced portion should not be longer than is necessary, so that the utmost rigidity is ensured. Another tip about end milling in the lathe is that it is well worth while to construct or adapt some form of collet chuck to hold the cutters. The ordinary three-jaw chuck, apart from being insufficiently accurate in most cases, interferes with a clear view of the work, while a drill chuck is not rigid enough for holding milling cutters, and its taper shank may work loose under side pressure. Should taper-fitted cutters or chucks of any kind be used for milling, it is best to fit them with a security bolt, passing through the mandrel and nutted at the outer end, to avoid this risk.

Cylinder Finishing

After cutting the ports, the cylinder bore may be finished by lapping, using methods which have been described in THE MODEL ENGINEER on several occasions. A combination of care, patience and correct methods constitutes the royal road to success in lapping, but it is really surprising how many constructors either fail to realise the importance of this process, or are in too much hurry to carry it out properly. I am generally averse to quoting limits for the accuracy of work which most constructors cannot gauge with the means at their disposal, but I have stated in a previous article that it should be possible, by ordinary lapping methods, to attain an accuracy well within a limit of 1/10,000 in., and it may be advisable to point out that a difference of 2/10,000 in. may make all the difference of working and not working in an engine of this size.

The bolting faces for the transfer passage and exhaust pipe should be finished dead flat by scraping, using a slip of plate glass as a surface plate, and finally lapped with a similar piece and some fine carborundum paste; the former is the more important of the two, as leakage here will result in loss of crankcase compression. As the tapping holes in this face will be located from the clearance holes in the cover, their position is not indicated by exact dimensions in the body details.

Main Bearing Housing

Most of the work on this component is straightforward turning, but a rather tricky little milling operation is involved in forming the supporting ribs which strengthen the overhanging end of the bearing. Now, it is quite practicable to dispense with these ribs by making the component heavier in section, and possibly tapered, or heavily filleted at the root where the flange and housing join, and many constructors would undoubtedly prefer to take this course. But I assure readers that the ribs are not put in just for ornament, and if we wish to combine lightness with adequate rigidity, we should not grudge the time taken to machine them. Incidentally, it is only by disposing just the right amount of metal in places where it serves a useful purpose that we can produce a true light-weight engine—which is altogether a different thing to a flimsy engine. Some of the constructors who complain that the machining work is too finicky will be the first to criticise an engine which fails to qualify for the flyweight record.

I imagine that most of the readers who essay a job of this nature will be of the type who take a real delight in the actual constructional operations—as distinct from those who merely regard the construction as a means to an end—and they will appreciate my contention that the engine in which all machining work is cut down to the bare minimum is not always the most satisfying from the model engineer's point of view. The main point is that if extra work is involved, it should be interesting in character, and devoted to a definite purpose, as distinct from mere elaboration. In this respect, I think that this engine should appeal to many who have hitherto regarded the petrol engine—and particularly the two-stroke—as lacking in scope for the ingenuity of the fastidious craftsman.

The first operation on the housing, as made to conform with the details shown, is to machine it roughly to the contour over the tips of the ribs, drill through the centre, and reamer to ¼ in. diameter. If one can be quite certain that the centre hole is dead true—which is possible with reasonable care—the machining may be finished outright at this end, using a hand tool to produce a sweeping curve and a good finish over the ribs; but if there is any doubt, carry this work out after the work has been mounted on a mandrel. Do not turn down the screwed part at the back of the flange, but leave this the full size of the rim, or slightly oversize, and part off. Make a mandrel to run between centres, a press fit for the bore of the housing, with a shoulder to locate positively at one end, and screwed to take a clamping nut at the other. It should not project more than about ¼ in. at each end, so that it is kept as rigid as possible.

(*To be continued*)

Model Locomotive Progress 1945

(*Continued from page 574*)

The experiment which impressed me most during the year 1945, was Mr. T. Linden's tests with vacuum brakes on his ¾-in. scale L.M.S. Pacific, *Princess Elizabeth*, i.e. engine, tender and truck. For three days, in bad weather, this engine was hauling twelve-passenger loads and braking entirely with the vacuum brake without a single failure. Its success was so impressive that many observers were of the opinion that model passenger trains of the future will use the vacuum brake. Mr. Linden's experiments with injectors, etc., are full of interest.

Mr. Keiller has also carried out experiments with high pressures, hot-water injectors, originality of design in 2½-in. gauge model locomotives, etc. His latest is a 4-6-0 engine having two high- and two low-pressure cylinders and relying entirely upon injectors for feed-water. This illustrates an advance in small-scale locomotive design.

We all owe much to the experimental model engineer; long may he be encouraged!

In conclusion, may I advise the beginner never to say or think, "That is good enough," but rather, "I can do better."

To model engineers in general I suggest that not only they should readily help and encourage each other, but to make it their motto to "always leave a smile behind them."

Fabricated Crankshafts

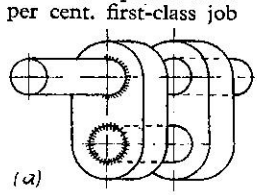
By N. Sneddon

THE contribution by Mr. Westbury in your issue No. 2395 in connection with fabricated crankshafts, is, as usual, extremely interesting. With regard to the possibilities of "freeze" fits, "dry ice" (frozen CO_2) is fairly easily obtainable in some areas and would doubtless be sufficient to achieve the necessary low temperature.

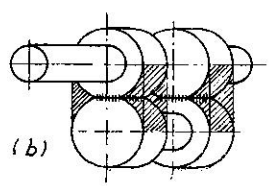
It is rather surprising that Mr. Westbury has not encountered a really satisfactory welded crankshaft, and one can only conclude that in each case the workmanship must have been faulty, or the design one that did not readily lend itself to welded fabrication. There is no reason to believe that the fusion welding process is inherently unsuitable for work of this class, and although it would appear that perhaps the flash-butt welding process would prove the most suitable from the quantity production point of view, there seems to be no real obstacle in the way of producing a really satisfactory crankshaft by manual fusion welding.

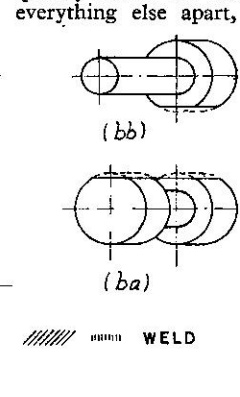
Slag inclusions, poor fusion and similar faults are, generally speaking, the result of faulty welding technique, but could conceivably be produced by bad design as well. In this connection it should be borne in mind that welded technique often demands a special design in the weldment, and whilst for simpler structures, adherence to the orthodox contours may prove satisfactory, it frequently happens that a fabricated welded component demands a completely new conception in design. This point is frequently overlooked by those unfamiliar with welded design, but may easily spell the difference between success and failure in a weldment. This, however, need present no special problems, and it is certain that a little thought and care applied to the projected design will result in a really satisfactory job. In order to make the desirability of designing specifically for welding, the accompanying rather rough sketches may be helpful

In sketch (*a*), which indicates the orthodox method of construction, at least four circumferential welds are required, all of them being more or less awkward and requiring very careful set-up and preparation to secure adequate fusion. It is doubtful if a 100 per cent. first-class job could be made with this type of design by any one other than a specialist at this type of work. It should be borne in mind that the foregoing remarks are intended to apply specifically to crankshafts, as there are other similar type jobs where such a set-up would prove perfectly sound.



Sketch (*b*) shows a welded crankshaft which avoids the weak points of (*a*) and, moreover, involves only two easily placed welds of the plain butt-type, simple of execution, and making it a matter of no great difficulty to ensure good fusion. Apart from this, (*b*) has only three parts as against the five of (*a*). The left-hand crankshaft is turned from the solid, the disc on the end being cut away on the dotted lines to form half of the web as at (*bb*). The dumb-bell-like object at (*ba*) forms the crankpin and the other two halves of the webs. The right-hand portion is simply a duplicate of (*bb*). Should a greater throw be required, a couple of plain rectangular plates would be welded between the two web halves.





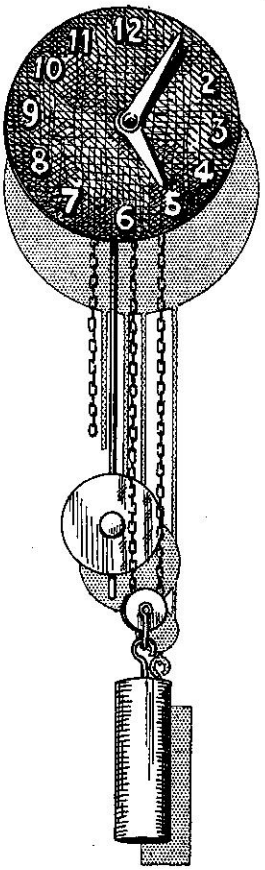
Mr. Westbury also suggests that the temperatures encountered in welding may have a deleterious effect on the weldment. This is not borne out by practice, and provided heat treatment is carried out, particularly in the case of alloy steels, no trouble from this source need be expected. In this connection, it is interesting to note that one well-known maker of outboard motors of advanced design welds the balance-weights on to the crank-webs, and another world-famous builder of marine engines utilises welding to fit a chain sprocket in the middle of the crankshaft. In both these cases it may be assumed that subsequent heat treatment is carried out to eliminate any harmful effects which may result from welding.

Finally, it cannot be too highly stressed that "any old metal" is not good enough for welding. The welding process has been described as a foundry in miniature. It is well to bear this in mind and to realise that, correctly made, a weld in certain steel may be left as welded, whilst in another, extreme and carefully controlled heat treatment is necessary after welding to ensure the best results. For instance, the free-machining steels having a comparatively high sulphur content, although eminently suitable for machining operations, are not satisfactory when welded, and should be avoided.

It is surprising, by the way, that more use is not made of the advantages of welding in model engineering. The equipment is not excessively dear and any model maker should be able to quickly master the essentials of the craft, which, everything else apart, is highly interesting in itself. Models fabricated by welding would seem to offer great advantages to the constructor, and, moreover, would be fully in accord with present-day practice, which is turning more and more to welded fabrication; locomotive cylinders, boilers, diesel-engine frames for submarines, and a host of other applications, where before only castings were deemed suitable or desirable, are being made in increasing quantities.

*A BRACKET CLOCK

By R.B.F.



FROM a piece of ⅜-in. diameter hardwood dowel rod, cut four pieces fully 1 in. long and four pieces fully ⅞ in. long; face these truly to the exact length and drill a 3/32-in. hole right through the centre. These form the columns; see Fig. 29. The column bolts are shown in Fig. 30 and are made from 3/32-in. diameter mild-steel rod; they should each be fitted with a 3/32-in. Whit. nut and washer.

The chain sheave is as shown in Fig. 31, and the weight should be about two pounds. A piece of tube, about 1½ in. in diameter and 5 in. long, filled with lead, will do; when casting the lead, fix a screw-eye in the centre of one end for attachment to the sheave.

The chain is of plain oval link and can be of steel or brass; it should be 60 links per foot and about 9 ft. long. This can be made to the instructions given in THE MODEL ENGINEER of April 27th, 1944; at one end, fit a suitable hook for anchorage to the right-hand bottom column, and at the other fit a ring. The chain in question was made from paper clips as described in the article.

The dial and hands need no description and can be made to suit one's own fancy; make the hands as light as possible. The hour-hand fits on the taper of the hour-cannon and the minute-hand fits on the square of the minute-cannon. Make and fit a bra s nut and washer to screw on the end of the centre spindle, to retain the hands in posit on and ensure a slight friction between the cannons and the spindle.

Now comes the assembly of the various parts and the final putting together and adjustment.

Mount the chain-sprocket on the centre spindle with the click facing the back of the clock; then put the click-wheel and the main wheel on the square portion of the spindle; the click-wheel must have its teeth pointing to the left when facing the front of the clock. Next, lock all in position with a nut and washer, and see that the chain-wheel revolves quite freely. The position of the main wheel is 7/16 in. from the middle plate to the back of the wheel.

Screw the second-wheel on to its spindle, and lock with a nut and washer so that the back of the wheel is 9/32 in. from the middle plate; then screw the pinion shroud on to the other end, leaving 5/32 in. between the two shrouds; fit the eight pins, which are cut from 20-gauge steel wire,

*Continued from page 553, "M.E.," June 6, 1946.

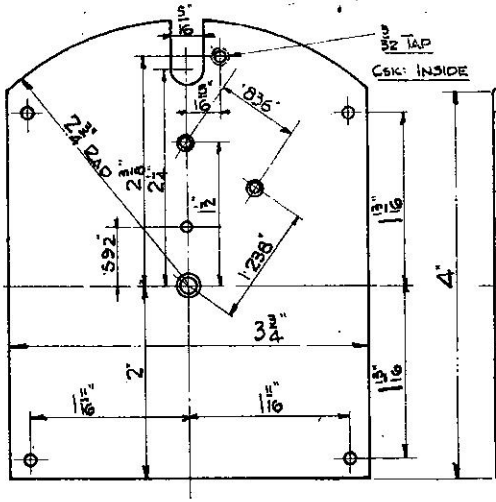


FIG. 26

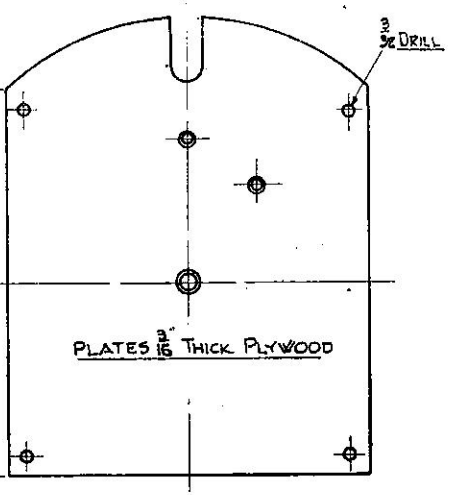


FIG. 27

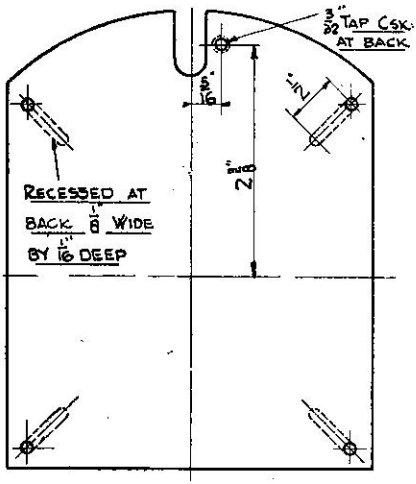


FIG. 28

s'ip on a washer to cover the ends of the pins and lock all in position with a nut.

The 'scape-wheel and pinion are assembled in a similar manner; the wheel should measure 1/8 in. from the middle plate; the teeth of the wheel must point to the left when viewed from the front of the clock.

Now fit the pallet in the slot cut for it in the pallet-spindle; pinch the sides of the slot down to retain the pallet in position; put the pendulum crutch in place and lightly fix it, by means of its locking-screw.

Ease the pivot-holes in the plates until the pivots run quite freely; assemble the plates and spindles and try for free-running. If everything is quite free and the wheels do not bind, take the plates apart and make small brass bushes for each hole, enlarge the holes and press the bushes in place. Should there be any binding of the gears, draw the holes in the required direction with a small round file and try again until all is free; then bush as already described.

On the front plate, 0.592 in. above the centre, drive in a steel pin to form a spindle for the intermediate hour-wheel and pinion. Fit the two 3/32-in. screws, to hold the two pallet spindle brackets, and retain them with nuts and washers. The slotted holes in these brackets are to allow of infinite adjustment when setting the pallet in beat.

Now we can reassemble the whole works; put the spring, Fig. 22, on the centre spindle, followed by the minute-cannon and hour-cannon. The intermediate wheel is retained on its spindle by the hour-wheel. See that everything runs quite freely; then hang the clock quite vertically on the wall or on a bracket, set the pallet and pendulum to give an even tick, and lock the pallet-spindle brackets and crutch in position. Fit the dial and hands and fasten the end of the chain to the right-hand column; thread the chain through the sheave and over the chain sprocket.

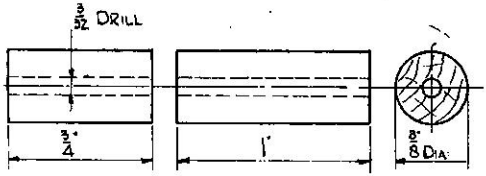


FIG. 29

Finally, make a dust-cover from a piece of thin zinc, or tin-plate, fastened at the two sides with small wood screws. If reasonable care has been taken, a fairly reliable clock will be the result; the one in question keeps time to within five minutes a week, which I suggest is not so bad for a clock of this description.

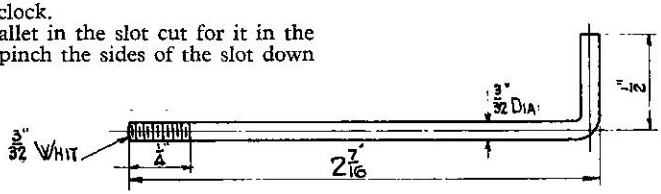


FIG. 30

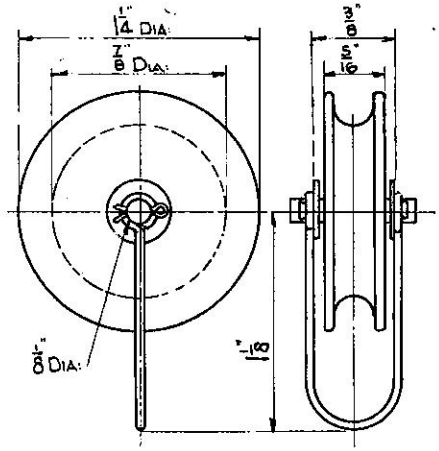
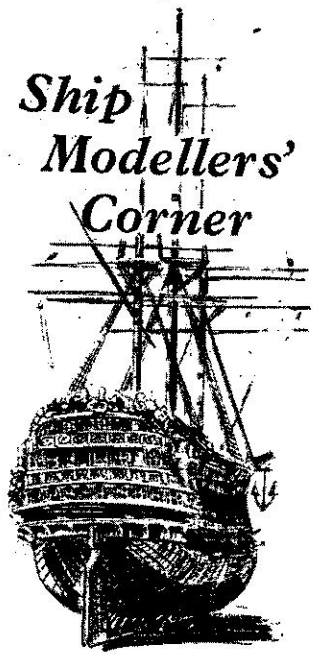


FIG. 31



Ship Modellers' Corner

By EDWARD BOWNESS

Rigging and topmasts are the subjects described in this instalment for the model 4-mast barque, "Archibald Russell"

WE can now proceed with the rigging of the bowsprit which was left over from the last "Corner." To secure the martingale or dolphin-striker, cut out a small piece of brass or tin 3/32 in. × ½ in., rounding the ends and bending it to encircle the bowsprit at the middle jib stay. The ends will come together with sufficient space left between them to receive the wire bobstay. The inner surfaces should be tinned. Next make the bobstay, using brass or copper wire about 24 s.w.g. Make this long enough to include the martingale and to allow of the other end being inserted into a hole in the stem. 1¾ in. will do nicely. Make a sharp bend in the wire 9/32 in. from one end to form the martingale, and tin it at the bend. Then pierce a small hole in the stem a little below the scroll, as shown in Fig. 57, to receive the inner end of the bobstay. Insert the bowsprit in the hull, thread on the clip, press the bobstay into the hole in the stem, and bring the other end to fit between the ends of the clip, as shown in Fig. 57. With a suitable bolster in one hand and the soldering iron in the other, press the clip together so as to sweat the ends to the wire between. A soldering iron is safer than a blowpipe when soldering clips which encircle wooden spars, as it does not burn the wood. Now drill a fine hole horizontally through the clip and the bowsprit, and a second hole for the fore-topmast stay—see 44, Fig. 60. Insert a fine wire in each hole, allowing them to project about 1/32 in. on either side. The bowsprit shrouds, which are actually made of chain, but may be represented by linen thread in a model of the size of ours, should be looped and glued over the ends of the wire at the clip and fixed to the hull just below and forward of the catheads in the manner already described for the mast stays. The alignment of the bowsprit should be checked and corrected if necessary when fitting the shrouds. The remaining rigging for the bowsprit should be left until the fore-topmast is fitted.

Topmasts

The fore-, main- and mizzen-topmasts may be made separately from the topgallant masts, as shown in Fig. 52, or, alternatively, they may be made in one piece, the space between them at the doubling being represented by a hollow on each side. At the lower end of the doubling the hollow is actually cut away for a depth of ⅛ in. to clear the shrouds. This will be found to simplify construction and erection, and the effect is practically the same as when they are built separately. However, as we may have some relatives of L.B.S.C.'s Inspector Meticulous amongst our readers, I will try to describe both methods.

To make the topmasts separately, cut off three lengths to the dimensions given in Fig. 52, and reduce them at the upper ends for the length of the doubling. The lower end should be reduced to $\frac{1}{16}$ in. diameter for a length of 1/32 in., to fit the hole in the lower mast top. To represent the trestle trees, cut out a rectangular piece of fibre or three-ply to the dimensions given in Fig. 58A. This is then slipped over the upper

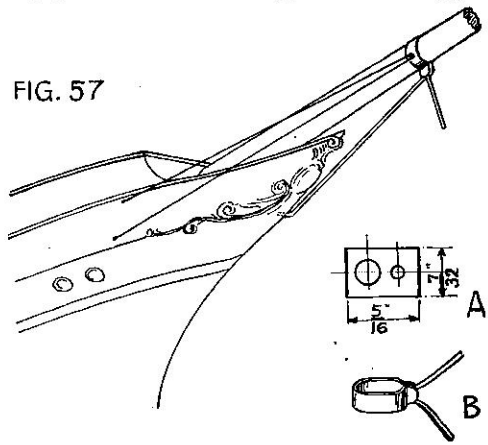
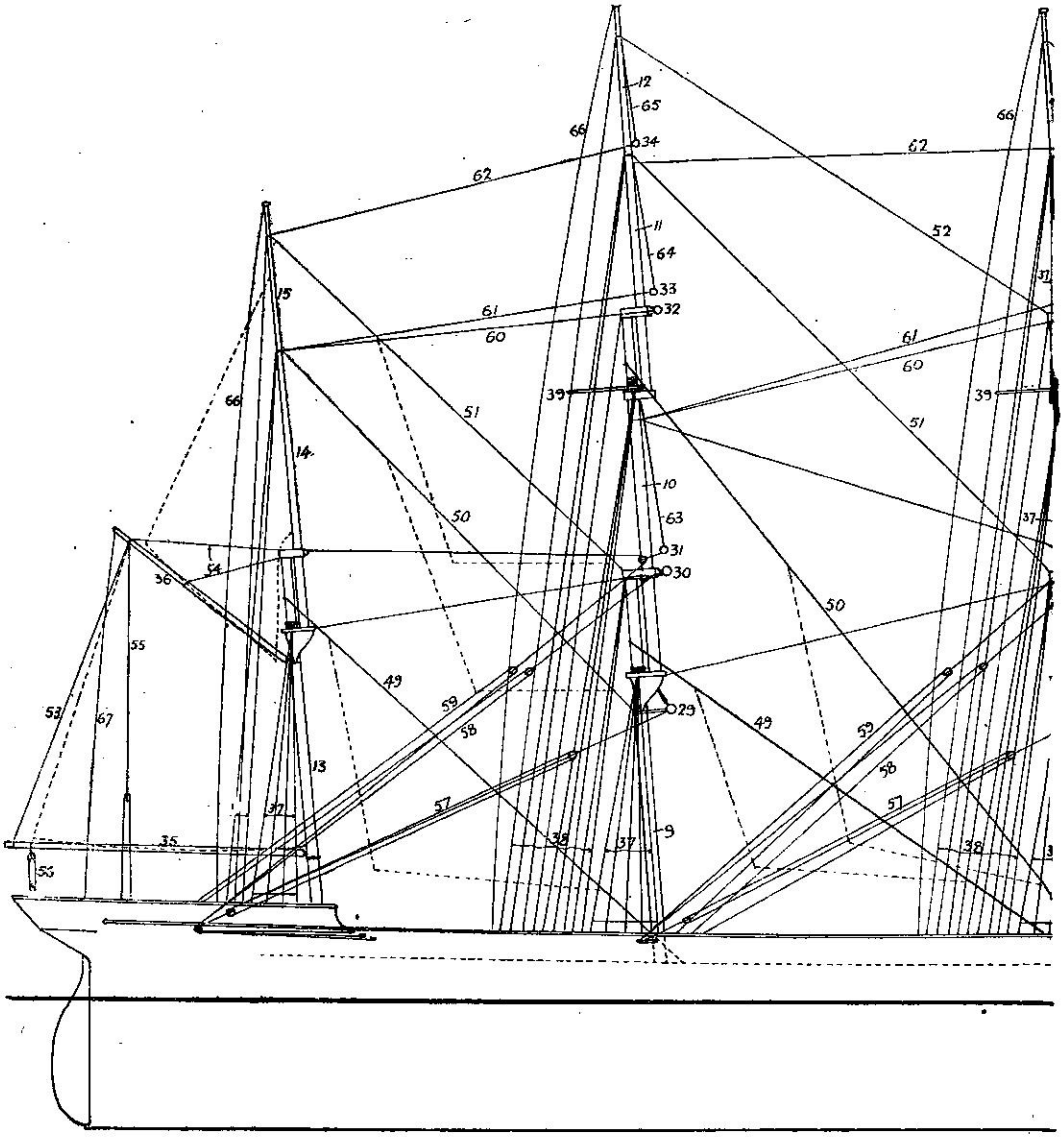


FIG. 57

FIG. 58
Not to Scale

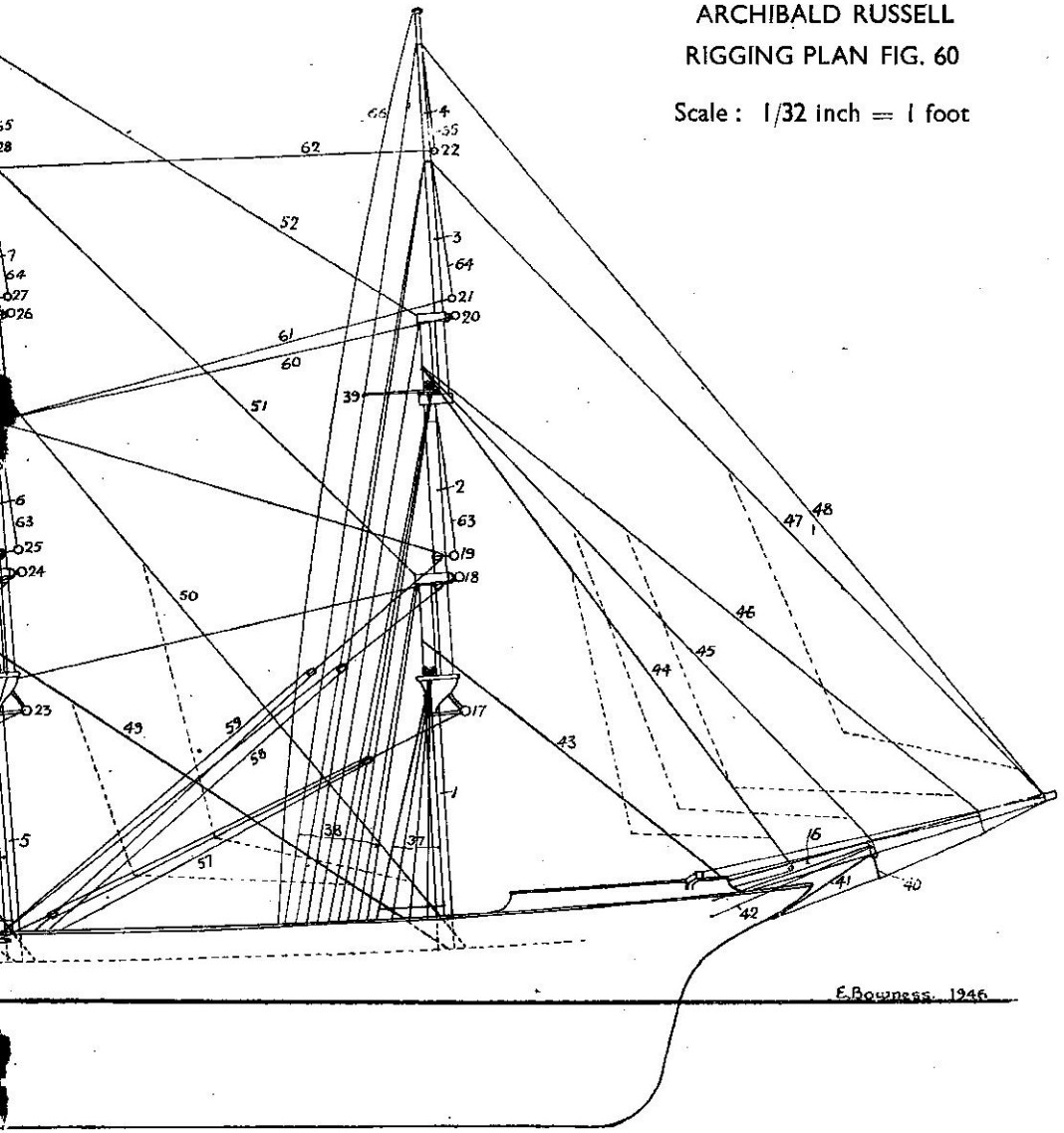
end of the topmast to rest on the shoulder made by reducing its diameter. Next make a clip for the mast cap, using a strip of brass or tin, 3/32 in. wide by ⅛ in. long, rounded at the ends



1. Fore mast
2. „ topmast
3. „ topgallant mast
4. „ royal mast
5. Main mast
6. „ topmast
7. „ topgallant mast
8. „ royal mast
9. Mizzen mast
10. „ topmast
11. „ topgallant mast
12. „ royal mast
13. Jigger mast
14. Jigger topmast
15. „ topgallant mast
16. Bowsprit
17. Fore yard
18. „ lower topsail yard
19. „ upper „ „
20. „ lower topgallant yard
21. „ upper „ „
22. „ royal yard
23. Main yard
24. „ lower topsail yard
25. „ upper „ „
26. „ lower topgallant yard
27. Main upper topgallant yard
28. „ royal yard
29. Mizzen yard (or cro'jack yard)
30. Mizzen lower topsail yard
31. „ upper „ „
32. „ lower t'g'lant yard
33. „ upper „ „
34. „ royal yard
35. Spanker boom
36. „ gaff
37. Shrouds
38. Backstays

ARCHIBALD RUSSELL
RIGGING PLAN FIG. 60

Scale : 1/32 inch = 1 foot



39. Spreaders
40. Martingale
41. Bobstay
42. Bowsprit shrouds
43. Fore stay
44. „ topmast stay
45. Middle jib stay
46. Outer „ „
47. Fore topgallant stay
48. „ royal stay
49. Main, mizzen and jigger stay
50. Main, mizzen and jigger topmast stay
51. Main, mizzen and jigger topgallant stay
52. Main and mizzen royal stay
53. Spanker boom topping lift
54. „ gaff „ „
55. Vangs
56. Spanker sheet
57. Fore, main and mizzen brace
58. Fore, main and mizzen lower topsail brace
59. Fore, main and mizzen upper topsail brace
60. Fore, main and mizzen lower topgallant brace
61. Fore, main and mizzen upper topgallant brace
62. Fore, main and mizzen royal brace
63. Fore, main and mizzen upper topsail halliard
64. Fore, main and mizzen upper topgallant sail (or "t'gans'l") halliard
65. Fore, main and mizzen royal halliard
66. Flag halliards
67. Ensign halliards

and bent to the shape shown in Fig. 58B, leaving a space between the ends to receive a wire clip for the yards. The ends should be tinned on the inner faces so that they can be soldered to the yard clip before fitting in position. This clip is a piece of wire, 24 s.w.g. by $\frac{5}{8}$ in. long, bent to form a vee and tinned at the angle. A similar but somewhat larger clip should be made for the lower mast cap, using a strip 3/32 in. wide by $\frac{11}{16}$ in. long, and, for the yard clip, a piece of wire about 1 in. long.

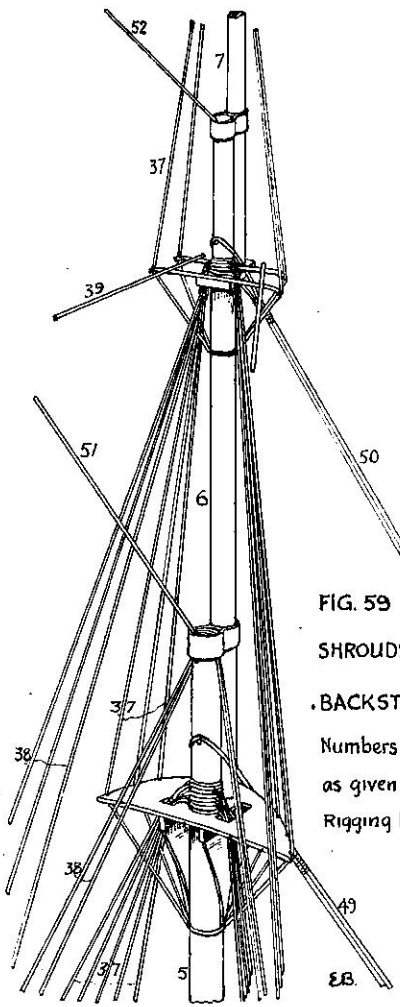


FIG. 59
SHROUDS & BACKSTAYS
Numbers are as given on Rigging Plan.

To erect the topmasts, first fix the larger clip to the lower mast head, inserting between it and the mast head on the after side a piece of cord, 8 in. long, for the topgallant stay (51), also looping over the top of the mast two 10-in. lengths for the lower mast backstays (38). Next put the foot of the topmast through the clip at the cap and between the encircling loop of the mast stay, inserting the $\frac{1}{16}$ in. diameter portion into the hole prepared for it in the mast top. Insert the wire yard clip between the ends of the mast clip and solder them together. To tighten the clip, press the sides into the space between the mast, as shown in Fig. 59, taking care to have the topmast parallel to the lower mast. Now fit the cross-trees, on top of the plate which represents the trestle-trees, one on the after side of the mast and one forward of it. These should be of wire, 24 g. by $\frac{3}{16}$ in. and $\frac{5}{8}$ in. long, bent at the ends, as shown in Fig. 59.

Shrouds

The topmast shrouds (37), should next be fitted. There are three on each side and they are fitted in the same manner and order as were those for the lower masts, except that there is only one pair and one single on each side. The lower ends should be continued downward to form the futtock shrouds, being brought over the edge of the mast top, which is notched to keep them from slipping forward, and continued downward to encircle the mast below the cheeks.

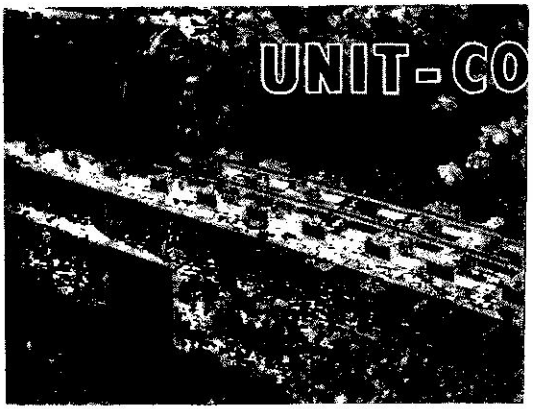
The lower mast backstays, which were left hanging loose from the clip at the mast cap, should now be fixed at the pin rail in the eyes provided. They should be tied to the eyes, adjusting the tension of the stay to keep the mast true, and the loose end should be tied to the stay at the level of the sheer pole. Similar knots should be made in all the succeeding backstays to give the effect of the bottle screws. Seal the knots with adhesive. Take care not to pull the backstays too tight or the cumulative effect will be to give the mast a very unseamanlike rake. The tendency amongst seamen is rather to have the stays taut, giving a slight forward rake, especially to the topgallant and royal masts. The ideal is, however, to arrange the tension in each direction so that the masts are straight and at the correct rake.

Backstays

Next come the topmast backstays. There are three on each side, and they are looped over the topmast head as is the case with the shrouds. In the model the odd backstay could be made in one with the odd shroud, thus making three pairs on each side. The cord for the backstays should be cut in 14-in. lengths, for the shrouds in 9-in. lengths, and for the odd shroud and backstay in 11½-in. lengths. The topmast backstays are fixed to the eyes in the pin-rail in the manner already described for the lower mast backstays.

The topmast stays, Nos. 44 and 50 in the rigging plan, are now required to complete the rigging of the fore, main and mizzen topmasts. They are similar to those for the lower masts, being double in each case, and they are fitted in the same manner, the only exception being in that for the foremast. The lower end of this is looped around the pegs in the base of the bowsprit and then carried aft to be secured in the vertical portion at the front of the fo'c'sle head. This may be seen in Fig. 60. The two members of the stay are seized together $\frac{3}{8}$ in. above the bowsprit, and not left free as was the case with the *Cutty Sark*, and which may be seen in the photograph reproduced in the issue for May 9th, 1946, page 455.

(*Continued on page* 588)



UNIT-CONSTRUCTION RAILWAYS

By "L.B.S.C."

How Mr. Ed. Adams does it

THIS being the time of year when it is usually more pleasant to do a bit of hobbying outdoors instead of in the workshop—providing there is no interference from Jupiter Pluvius to damp the proceedings!—some of the good folk interested in these notes are putting long-neglected railway tracks in order. Also some of our friends who have recently emulated Angus Macdonald of the ballad, have found their temporarily-abandoned roads need more than a little titivating up. It therefore seems an opportune time to call attention to the latest form of construction evolved and applied by Mr. Edward Adams, whose skill as an architect is well known to many of our readers. His designs are always sound, ingenious, and well executed; the present example is no exception. It is a unit form of construction, embodying the cross-sleeper-plus-batten idea, but embodies novel features, especially in the method of rail fastening.

Mr. Adams's original road was laid to 2½-in. gauge only; but he has recently reconstructed it as a multiple-gauge line with four rails giving three gauges, 3½-in., 2½-in., and 1¼-in., the two original rails being retained, and two new ones added. It is built up in 10-ft. units, which can be removed bodily by taking out two screws and slacking off four others at each joint, so that any adjustment or repairing that may be needed could be carried out in the workshop, and the woodwork can be easily given a fresh dose of creosote as required.

Mr. Adams found that the small sleepers previously used were frequently damaged by derailments and so forth—we all know what kiddies are!—so this time, the new sleepers are distinctly on the "Bill Massive" side, the running sleepers being ¾ in. in thickness and 1½ in. wide, whilst the width of the joint sleepers is increased to 2 in. Actually, they are made from slating battens, planed to required thickness; and each narrower one has a groove ½ in. wide and $\frac{1}{16}$ in. deep, machined in the top surface. The idea of the groove is to house Mr. Adams's special type of rail-chair or clip, which grips the foot of the flat-bottomed rail, and is held down by ½-in. No. 8 round-head wood-screws; the clip holds one side of the rail flange, and the head of the screw, the other. All the screw and nail holes are drilled by jig. As the clips are sunk in the grooves provided, the rail bears on the sleeper for its full width, and is only unsupported between the adjacent sides of the sleepers. This allows of less sleepers per foot, and wider spacing, than if the rails were supported by the widths of the chairs or clips alone. The joint sleepers have a groove 1 in. wide, with a double-width clip held by two screws, one against each abutting rail; to detach a section, it is merely necessary to slack the four screws, remove the two batten screws, and slide the rails out of the clips. No holding down of the sections to the longitudinal runners has so far been found necessary; Mr. Adams says he is of the opinion that the sections would be equally satisfactory if mounted on concrete supports, or would do for a ground-level line, with suitable packing for keeping the sections level. The battens, or side runners, are placed at the extreme ends of the sleepers, and secured by nails, except at the joint sleepers, where screws are used to render detachment easy.

On the curved sections of the line, the new construction was built up on the existing runners of the original line; and once assembled, the sections kept their shape. Small wedges are placed in the spaces where needed, to provide for lateral adjustment, and keep the curves correct until the new timber has had time to settle down. In the photograph, only two rails are shown; the others were not laid when it was taken. The runners are also new, replacing old ones which were full of knots and had become unfit for further service. As the original small washers under the bolt-heads and nuts had become pressed into the wood, new ones of 1¾ in. diameter are now used; and spanner holds have been formed at both ends of the bolts, to counteract their tendency to turn in the wood when being tightened. Threads and nuts are well treated with vaseline before being assembled. This seems to be a very satisfactory form of construction, simple and easy as usual, and our old friend earns the usual appreciation for his kindness in forwarding the drawing, photograph, and details. The engine shown in the picture is his big 4-8-4, which has now completed 140 miles of running, despite the unwelcome attentions of Jerry during the blitz days.

Vindication of the "Doughgirl"

"You can have too much of a good thing," is an old saw with a mighty lot of truth in it. Patriotism is a good thing, but when one reaches the stage of turning up one's nose at anything that isn't British, irrespective of its merits, merely because it was not made in this country, is just carrying a sense of proportion to an absurdity, about as logical as the million men who built a 500-ft. brick wall in one second. Incidentally, I could name several Borough Councils, and at least one Government department, who could do with the services of that gang! Well, when the American-built "Austerity" 2-8-0's, known as "Doughgirls," "Gipsy Rose Lees," and sundry other nicknames, first arrived in this country, the super-patriots immediately went out of their way to cast all possible aspersions on them, and held up the British-built "Austere Adas" as a shining example of the proper way to do it. Although primarily intended for military use on the Continent after the invasion by the Allied Forces, many of the engines were put to work in this country, to help our own overworked and sadly neglected iron horses deal with the abnormal rail traffic then obtaining; and the result was a bit of an eye-opener for certain people, to say the least of it! The British-built "Adas" proved to be coal-eaters, and hadn't been on the road the proverbial five minutes before they began to suffer from boiler trouble; at one shed—"somewhere in England," shall we say?—every "Ada" stationed there was laid up with boiler trouble at the same time! Several of the goods trains passing the back of our hacienda were regularly worked by the "Adas," and a sorry figure some of them cut, climbing the 1 in 264, even with moderate loads.

Things became so bad that a certain locomotive superintendent arranged a comparative test between an "Ada" and a "Doughgirl"; the latter were giving general satisfaction, except in certain isolated cases where failure had occurred through British enginemen not being used to handling American-type locomotives. For example, one case of a burnt and collapsed crown sheet, was found to be due to the top cock of the water-gauge being shut off, so that the glass indicated a full pot, whilst actually the water had sunk below the crown of the firebox. Anyway, the test referred to consisted of starting a full load at the bottom of a bank, with low steam and water. The "Ada" konked out; the "Doughgirl" not only took the train up, but arrived at the top blowing off with the injector working. The net result of that test was the appearance of the ten-coupled "Ada" with a bigger boiler and wide firebox, very similar to the general design of the "Doughgirl's." It was also properly lagged, instead of having a sheet-iron casing around it, with nothing in between; a funny sort of "lagging" in any case! The proof of the pudding was, as always, in the eating; and despite the assertions of the super-patriots, British was *not* best in this instance.

The Sequel Tells Its Own Story

There are still some locomotive engineers who recognise and appreciate any engine that does its job and keeps on doing it in the approved manner, whatever country it originated in, and whoever built it. If Fatty Hermann had built a Jerry 4-6-2 in 3½-in. gauge, with a swastika-shaped smokebox handle, and "A. Hitler, driver," painted up inside the cab, and it had hauled a dozen passengers around my road for half-an-hour non-stop with the lever next to middle and without touching the fire, I'd have just loved it, irrespective of the particular brand of affection (?) I have for the parties mentioned, or the engine's country of origin.

However, after the test mentioned in the previous paragraph, the engineer in question sent to the locomotive builders, across the big pond, for the drawings of the "Doughgirl," and wasn't averse to learning a thing or two from them. Other locomotive engineers apparently did the same, great minds ever thinking alike; for in 1943, the question of a suitable type of engine for general use in Europe after the liberation, to replace those stolen or destroyed by Jerry, came up for consideration by a committee of locomotive engineers, the Ministry of Supply, and the Locomotive Manufacturers' Association. To cut a long story short, after all the requirements had been settled, the Vulcan Foundry Company undertook the final design and production, and the result was—hold your breaths, ye super-patriots—the "Doughgirl's" daughter! They called her "Liberation."

The Vulcan-built "Doughgirl" made her appearance forty-five years or so too late—we could have done with a few like her on the Portsmouth goods, instead of the awful contraptions from the same firm (no fault of theirs, I hasten to add; they were built to order) which friend Hambleton called "lovely," but which the drivers and firemen who handled them called—ah, um! I had better not put that down, because our friend the K.B.P. would promptly use the said B.P. on it. The family likeness is instantly recognisable. The daughter differs very little in personal appearance from her mother, except that she has plate frames instead of bar frames, and slight differences in the appearance of the valve-gear, such as different link supports and so forth; she also uses the bottom half of the link for going ahead, and is reversed by a wheel and screw. Otherwise, she has the "Doughgirl's" big high-pitched boiler, with its wide firebox, arch tubes, rocking grate, sandbox on the barrel, and other characteristics; the American type of cab, and a tender running on two four-wheeled American-type bogies, believed to be the first of their kind ever made in this country. They have spoked wheels, which look awfully out of place with this kind of tender truck; personally I should have thought that the usual pattern of disc wheel would have been more serviceable, seeing the work for which the engines are required. The spoked wheels and diamond-frame bogie match about as well as a top-hat and kilt.

The engine, taken by and large, is a sturdy job, with big cylinders (21⅝ in. by 28 in.) and a boiler pressure of 227 lb., so she ought to be able to do the doings all right. Whatever the super-patriots have to say about it, the design and appearance of the "Liberation"-type is pretty good evidence as to which of the "Austerity" types was the better proposition; for, had it been the "Adas," it is

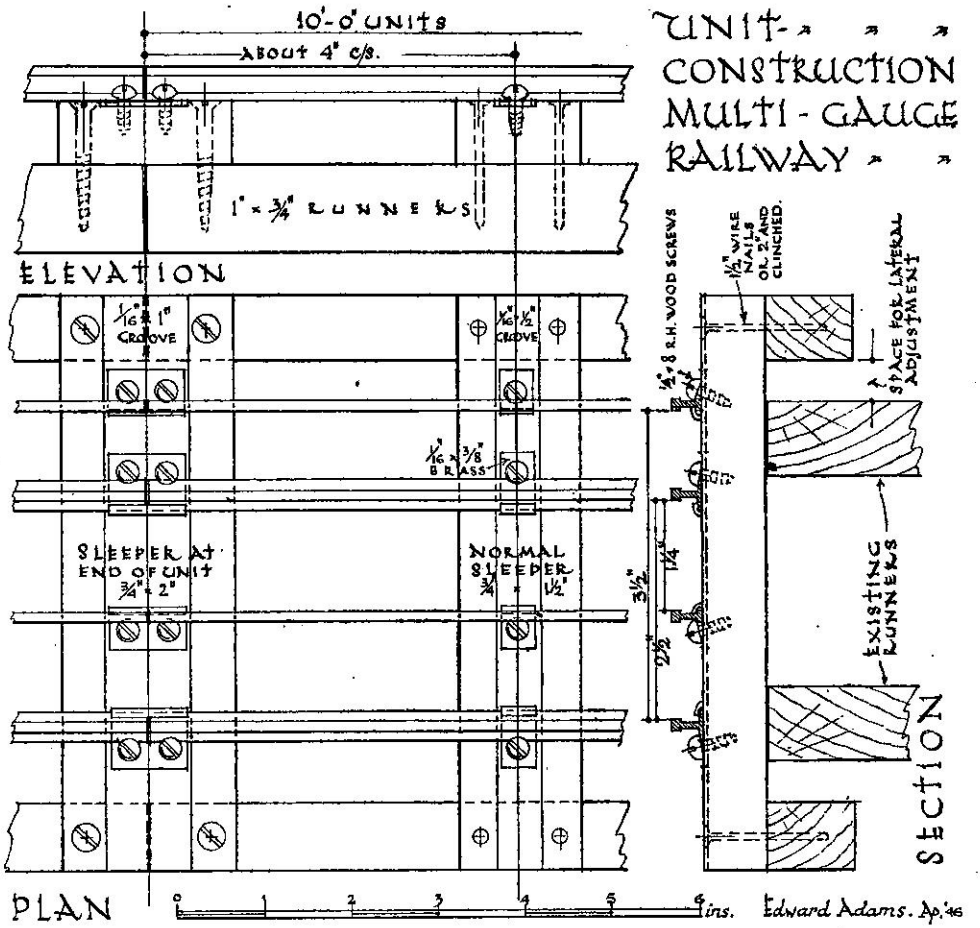
feasible to assume that this engine would have borne a family likeness to them, seeing that a large number of "Adas" were actually built by the Vulcan Foundry, to the order and specification of the Ministry of Supply.

False Alarm!

To reassure new readers, I had better mention here that the 2½-in. gauge version of "Austere Ada," which I described how to build in these notes some little time ago, had none of the faults and failings of its full-sized sisters. You can bet your sweet lives that Curly saw to that all right, and no hot-air intended. As a matter of fact, the firebox was wider than I usually specify for a 2½-in. gauge engine with a firebox between the frames, as the small wheels and low frame enabled the foundation-ring to sit on the frames instead of going down between them, a feature which was not present in the full-sized job; and of the many that have been built, I have yet to hear of one that has ever been short of steam. Four adult passengers is quite an easy load. They may also be interested to know that I got out all the doings for a 2½-in. gauge "Doughgirl," complete with bar frames and all the blobs and gadgets of big sister; a fair number were built, and castings (including cast bar frames) and a full-detailed set of blueprints are still available. As to a small edition of the "Liberation" engine, she would absolutely be "the cat's whiskers" in 3½-in. gauge for those good folk who specialise in taking a locomotive to charity fêtes, and such like functions, to haul a crowd of kiddies on an up-and-down road. The big cylinders, and eight-coupled wheels of small diameter, are ideal for the constant starting and stopping; the big boiler, with its wide firebox, providing ample steam with the minimum of attention. A picture, and an outline drawing of the engine, are given in the May-June issue of *The Railway Magazine*; and for anybody interested, here is a brief specification for 3½-in. gauge.

Dimensions of 3½-in. Gauge "Liberation" 2 8 0

Plate frames of ⅛-in. steel, with horns and axleboxes same as "Bantam Cock" or "Hielan' Lassie." "Bantam Cock" pony truck complete, but with 2⅛-in. wheels. Eight-coupled drivers, 3⅜ in. to 3½ in. diameter; "Iris" castings would do. Cylinders, 1⅝ in. by 1¾ in., either piston- or



slide-valves as desired. The castings sold for the L.M.S. Class 5 cylinders that I described a year or more ago would come in just right, if bored to the limit. Valve-gear similar to "Lassie," but the links would be hung in a girder bracketed to the frames above the second pair of coupled wheels. "Lassie" guide-bars and crossheads. Boiler, 4¾ in. diameter, with an inside firebox 6 in. long and 4½ in. wide; no combustion-chamber would be needed, as the boiler barrel is comparatively short, and the tubes would be about 11 in. long, which would settle their diameter at 7/16 in. Four ⅞-in. superheater flues with 5/16-in. elements. Tender wheels 2⅝ in. diameter. Approximate length of engine, 2 ft. 6 in., and with tender complete, about 4 ft. 3 in.; a nice hefty lump to lift, but not too big or heavy for easy portability. If I can manage to squeeze in the time to make an outline drawing of her, and the K.B.P. doesn't raise any objection, I will give same in a future note; the engine could be easily built, without any specially detailed instructions, by following out the machining, fitting, and erecting operations given in detail for other engines in this series.

Where the Power Goes

From time to time, readers who have purchased used engines, of commercial, professional, or amateur build, write and ask how they can increase the power developed, or reduce an abnormal water and fuel consumption, or ask a cure for some other complaint that locomotives are heir to. Only last week (time of writing) a correspondent said he owned a commercially-made 2½-in. gauge Pacific with cylinders 1/16 in. by 1 1/16 in. (some say, "good old standard"; you know the rest!) which would haul his small son when blowing off at 80 lb. pressure, but as soon as he tried to get a ride, the engine refused to move unless given a push, and even then stopped after a few turns of the wheels, even though it had not lost pressure. Could I suggest what was amiss with it?

The most common, and also the most insidious, complaint which robs a locomotive of power, is a blow past valves, pistons, or both. Common, because many good folk of all the classes mentioned above are prone to spend more time on what is commonly known as "spit and polish" than on things like careful piston and valve fitting, which, though unseen, are the things that really matter. The engine referred to above, for instance, is very nice *to look at*; but looks won't pull a train! The complaint is insidious, because it "gets away" without being noticed; the escaping steam goes up the blastpipe quietly and unobtrusively, entirely different from steam blowing from a leaking gland. Instead of the admitted steam being held between piston and cylinder cover, and exerting the full boiler pressure—less the slight drop in the steam pipe—on the piston head, the steam leakage past either piston or valve considerably reduces the pressure in the cylinder; hence the loss of power, even though the boiler is blowing off. Sometimes even this blowing-off is the direct result of the blow-by in valve or piston, as the escape of steam up the blastpipe urges the fire, and so produces more steam to blow to waste. The vicious circle!

Sometimes the trouble can be temporarily cured, provided that the pistons are a fairly good fit, by repacking them; but the only really satisfactory permanent remedy is to take the cylinders off, re-ream them dead true with an expanding reamer, or set up in the lathe and rebore them about 1/64 in. larger, following the instructions I have already given for machining cylinder castings. Then fit new pistons to the recommended clearance, as per my usual "words and music." Lubrication should, of course, be above suspicion; and whilst the cylinders are off, reface the ports and valves. A truly-bored cylinder, with a properly-fitted piston and valve, and adequate lubrication, cannot fail to deliver the maximum of power for the steam supplied to it.

Tail Lamps

Correspondents please note; I don't write, nor do I ever intend to write, under any other nom-de-plume than the railway initials "L.B.S.C."—imitation is the sincerest form of flattery!

The last straw—the rumour that the "Cornish Riviera" will soon be hauled out of Paddington by a gas-driven spinning-jenny. Ichabod!

Ship Modellers' Corner

(*Continued from page* 584)

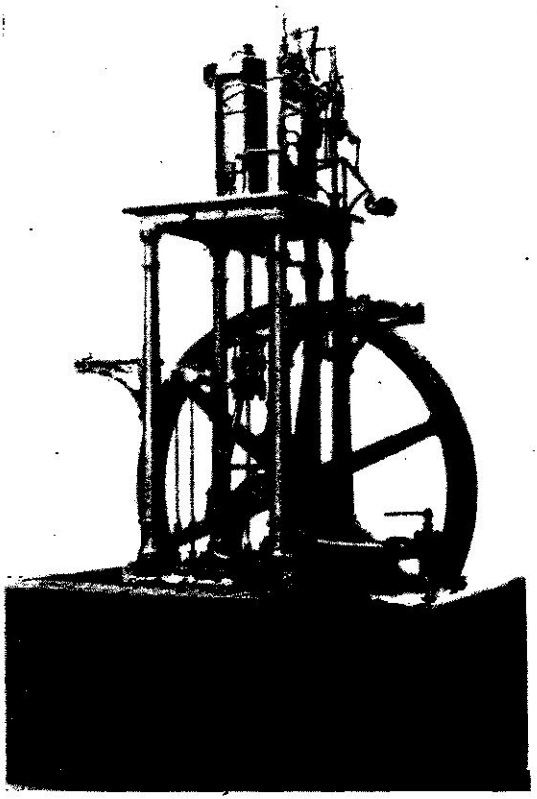
A guide to the size of cord or thread to be used in the rigging will be given when we say that, in the actual ship, the shrouds, stays and backstays up to the topmast are 4⅝ in. circumference, reducing as we go higher, until the royal stays and backstays are only 2½ in. circumference. In the jigger mast the lower shrouds and stays are 3½ in. circumference. Whether the model is rigged with cord, surgical silk, wire, or linen thread, the scale diameter should be adhered to as far as possible. A useful way to measure the diameter is to wind closely a number of coils on a stick, measure the width wound, and divide by the number of coils.

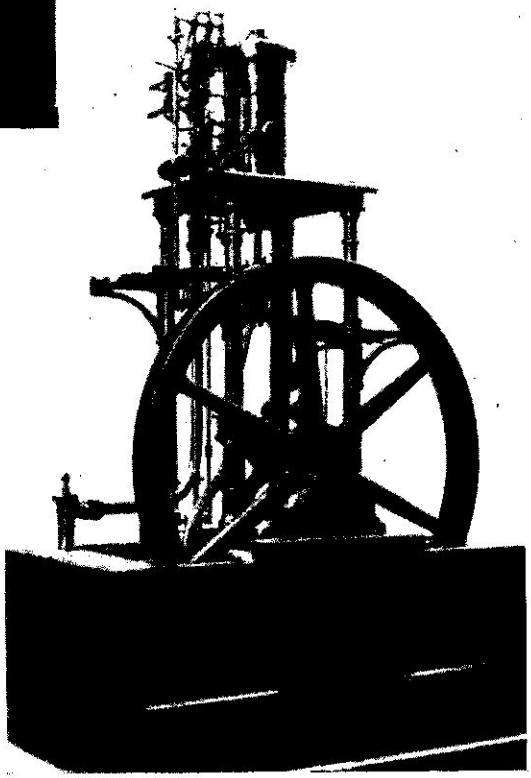
With this issue we give a rigging plan of the *Archibald Russell*, showing the standing rigging and the braces. The lead of the halliards from the mast to the deck is not shown, but will be given in due course. The upper shrouds are omitted on the fore, mizzen, and jigger masts, for the sake of clearness. The drawing is exactly half the size of the model.

In conclusion, I would like to add a note on the sketch of the stern, Fig. 50, in the issue for March 28th. This gives a rather bulging effect under the counter, which is somewhat misleading. The line from the knuckle of the counter to the hole for the rudder post is straight, as will be seen in the outline of this part in other drawings, particularly in Figs. 10 and 60.

A MODEL PIT ENGINE

E. J. HOWLETT, M.I.Mech.E.





THE photographs reproduced herewith may be of interest to some readers. They are of a model pit engine that I acquired some time ago. The plate states that it was awarded first prize at the London Exhibition of 1862. Although I cannot confirm or disprove this statement, I can say that the workmanship is of a very high standard, and would, I think, compare favourably with some of the better exhibits at recent model engineering exhibitions.

The model stands about 2 ft. 6 in. high, and is built to a scale of about 1 in. to 1 ft.

Unfortunately, the photographs do not do full justice to the model, as a lot of good workmanship, such as the feed, circulation and air pumps, is lost.

A PROPOSED DRAWBAR-PULL REGISTERING DEVICE

By K. N. HARRIS

FROM time to time those of us who are interested in fundamental principles and their scientific application to model locomotive problems, plead for more factual and exact information on model locomotive performance than is provided by the sort of statement that some particular engine "easily hauled five men and a few small boys." I should say that a statement of this nature without a whole heap of supplementary and exact data is, for practical purposes of computing the power and efficiency of a given engine, or even of comparing the performance of two or more engines, completely valueless.

The number of factors that influence the tractive force necessary to set in motion and keep moving some given weight is large. Let us consider a few of them :—

(1) A very slight incline in either direction will have a marked influence on the effort needed to move a stated load.

(2) *Condition of rail surface*, under which head come smoothness and degree of hardness. It is an accepted fact that many engines of the mid-Victorian period gave much better results in their later days when steel rails had replaced iron and their original iron tyres had also been replaced by steel ones.

(3) *Type of bearings and their condition.*—The difference between the power needed to move a trolley mounted on poor plain bearings and one mounted on first-class properly-housed ball- or roller-bearings is great.

(4) *Springing.*

(5) *Lubrication.*

(6) *Weather conditions.*

Every one of these factors influences in some degree the pull needed to set and maintain in motion a given load.

Mr. W. B. Hart, who has an extensive continuous track to experiment upon, pointed out in these columns not very long ago that a similar load on the same trolley would at different times require a varying tractive effort to shift it.

Perhaps, the supreme illustration of the uselessness of this "load shifting" method of rating is the classical case of the three girls pulling the 350-ton "Timken" bearing locomotive with a piece of bell wire. It would be fair to assume that these young ladies could not exert a pulling force in excess of 100 lb. each (actually that is setting it very high), which means that, under certain conditions, taking the 350 tons to be American "short" tons of 2,000 lb., a pull of 1 lb. will set in motion a load of 2,330 lb.! I don't advise anyone to use this as a basis of calculation for other cases!

Supposing there was a gradient of only 1 in 1,000 *against* the girls, the direct weight acting against them would be 700 lb., far more, of course (unless they were exceptional young females), than their own total weight. On the other hand, a gradient of 1 in 1,000 in their *favour* would promptly give them the equivalent of 700 lb. on their bell-wire towline before they started to pull. These few paragraphs may help to show the futility of the type of "rating" to which I have referred.

Obviously, one of the most important of the factors we want to be able to measure with reasonable accuracy is tractive effort, under all sorts of conditions. The spring-balance, usually brought into action for this purpose is not by any means satisfactory; it possesses no inherent stability or damping effect, and it is not easy to incorporate apparatus to provide it.

There was published in THE MODEL ENGINEER for June 7th, 1923, a design for a hydraulically-operated device, which indicated drawbar-pull by means of a pressure-gauge. This, whilst a great improvement on the spring-balance, is open to the objection that it would be very difficult to eliminate errors due to the friction of the ram and its packing.

The device illustrated herewith is put forward as a possible practical solution of this difficulty. It works on the torsion principle and embodies an adjustable hydraulic dashpot. (Note that the friction of the dashpot does not interfere with correct reading, as it is taken care of in the calibration.)

The torsion members are made of strip-steel, spring-tempered, of varying thicknesses, which can be very quickly changed.

The device consists of a main frame, embodying an angle-bracket for clipping to the buffer-beam of the towed truck. In a boss in this frame, is mounted a shaft which projects through the boss at both ends, one end, the inner one, being suitably slotted to accommodate the torsion member. Opposite to this end of the shaft is a fixed abutment, also slotted to hold the other end of the torsion member.

At the outer end of the shaft are mounted a gear-wheel, a horizontal arm and a flat-faced pulley, all fixed to the shaft. Above the gear is mounted a pinion, the shaft of which carries a long indicating needle, which moves across a brass quadrant, on to which can be clipped the calibrated scale corresponding to the torsion member in use.

The outer end of the horizontal arm is slotted and acts on a pin in a forked joint of a piston-rod which, in turn, is connected to a long piston made an accurate fit in a bronze cylinder. The piston-rod works through a packed gland. The two ends of the cylinder are interconnected through a passage controllable by a needle-valve. Drain plugs are fitted top and bottom of cylinder. A second cylinder with a spring-loaded piston can be put into communication with the main cylinder.

The whole system is filled with thin oil, great care being taken to get rid of all air. The purpose of the spring-loaded cylinder, the piston of which

takes the form of a cup leather, is to act as a feeder to the main cylinder to make up any loss of oil through its gland; normally the valve between them is shut. By adjusting the needle-valve controlling the passage connecting the two ends of the cylinder any required damping effect can be obtained.

To the flat pulley is attached, on what is the underside when at rest with a torsion member in place (when the needle, too, will read zero), preferably a steel tape, long enough practically to surround the pulley and leave 3 to 6 in. over. The end of the tape carries a strong wire loop. If steel tape is not available three or four thicknesses of strong linen-tape sewed together can be used. Actually, the end of a scrap steel measuring tape is very suitable.

To calibrate, the bracket is clipped in the vice, a blank paper scale attached to the quadrant, and a weight, say ¼ lb., hung on to the end of the tape, which itself is, of course wrapped over the pulley. This will cause the shaft partially to rotate against the resistance of the torsion member and a mark should be made on the scale opposite the needle, recording a pull of ¼ lb. Add, say, 2 ozs. and mark again and continue until the torsion member is twisted through not more than 15 deg. (which will give 60 deg. movement on the scale). The scale should be numbered to correspond with the torsion member in use. Obviously, if a very stiff torsion member is used, then the initial weight will require to be greater as will the succeeding increments.

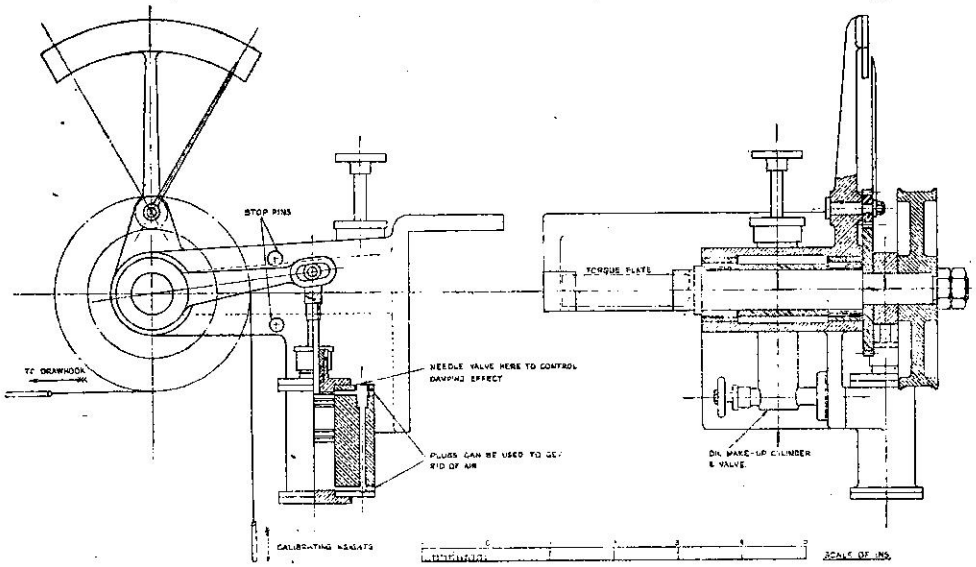
The size of apparatus shown is suitable for 3½-in. to 5-in. gauge, but the principles involved are, of course, applicable to larger or smaller sizes respectively.

If one wants to do the job properly, a complete dynamometer-car should be constructed and this pull-recorder would need considerable modification in detail to adapt it to record continuously upon a chart driven by a clockwork motor at a known speed. On the same chart would be recorded, by a separate apparatus, the distance travelled. This would be operated by a light wheel of known circumference, say 12 in., held in contact with one of the running rails by spring pressure and driving, through a light train of reducing gears, a marker which would make a dot on the chart for, say, every 10 ft. of travel of the car.

Thus, on the one chart would be recorded directly continuous drawbar pull and distance travelled, and, obtainable by simple calculation, average speed over any distance in excess of 10 ft.

In use, the device is fixed to the front of the truck to be hauled and the tape connected to the engine drawhook, a suitable torsion member and scale having been previously chosen. The use of a pulley instead of an arm for the attachment of the drawgear ensures that the radius at which the pull acts is constant. A simple calculation will serve to give an indication of the approximate range of torsion member for any particular job. The following formula has been published many times before, and it gives the *maximum* tractive effort the engine can *possibly* attain. It has been not infrequently stated that such-and-such an engine exceeds its calculated tractive effort, and this has been adduced as evidence of the uselessness and futility of figures. The explanation is simply that tractive effort is almost always worked out on a basis of 75 to 85 per cent. of the boiler pressure being available behind the piston.

In an engine designed on modern principles with steam passages of ample cross-section and easy contour from regulator to exhaust-nozzle, even the higher figure is likely to be exceeded up to reasonable speeds; and even on an engine which may not be all it should be in this respect, the figure may still be exceeded at very low speeds. If the *maximum* pressure which can be got into the cylinder is known, and the calculation



Pull-registering device with hydraulic damper

is made on this basis, then it is a physical impossibility for an engine to give a tractive effort in excess of that calculated.

The formula is $\frac{D^2 \times L \times p}{W}$ where D equals cylinder diameter ; L equals stroke, and P equals pressure, generally taken as being 75 to 85 per cent. of boiler pressure and W equals diameter of driving wheels. D, L and W, all being in the same units, inches for preference. This goes for a normal two-cylinder engine ; for a three-cylinder add 50 per cent., and for a four-cylinder multiply by two. Compounds need special treatment :—

Example : Boiler pressure, 100 lb.
Cylinders (two), $1\frac{1}{4}$ in. × $2\frac{1}{4}$ in.
Wheels, 5 in. diameter.

$\frac{(1.25 \times 1.25) \times 2.25 \times 85}{5}$ equals 60 lb.

If, however, we had taken " P " as 100 lb., then, unless P is exceeded, an engine of these dimensions working at this pressure is physically incapable of exceeding 70 lb. tractive effort.

It is quite likely to be said that it is not worth the trouble involved to make such an instrument ; that is a point of view which anyone is entitled to hold and express. Quite a lot of people hold that making model locomotives is a most futile way of wasting time ; they, too, are entitled to their opinion. I disagree with both viewpoints. I happen to believe such apparatus to be well worth while and of help in obtaining useful and reliable data of a factual nature, just as I believe designing and building small locomotives (and many other types of model) to be an absorbing, even if not particularly useful or profitable form of occupation.

Letters

Burrell Compound Engines

DEAR SIR,—I was greatly interested in a letter recently published on the Burrell single-crank compound engine.

This engine, No. 2960, was built in the year 1907 and is undoubtedly of the type mentioned above.

I fear, however, that Mr. McDowell must have been misinformed by the driver, who stated that only five or six of this type were built by Burrells, for although I am not in a position to state the precise number built, I can definitely say that by the end of the year 1901 there were more than 800 of this type of engine in use.

I have seen a photograph of Burrell's erecting shop, which was published by the firm, and there are about eight of this type clearly discernible in course of erection.

Trusting this letter will be of interest.

Yours faithfully,

Liverpool. M. C. FAYRES.

Machining Crankshafts

DEAR SIR,—May I suggest a method not mentioned in Mr. Westbury's recent articles on machining solid crankshafts ? It is not applicable to all types of shaft, but can normally be used on shafts for single-cylinder engines or for twin-cylinder engines where the cranks are close together axially, as on a horizontally-opposed twin engine.

The method is as follows : The bar from which the shaft is to be made is centred at the ends for the shaft axis only and is finish-turned off these centres, with the exception of the big-end and the inside faces of the webs.

A steel bar of suitable size is mounted horizontally on the top slide, the length of the bar being at right angles to the lathe axis, and a hole bored in it, preferably with a small boring-bar, to take tightly the shaft journal on the side projecting farthest from the webs. The crankshaft is then inserted in the hole and locked by some means, such as a pinching-screw, and the cross-slide moved back by an amount equal to the crank throw. A hole is then drilled through the solid centre part of the shaft, where the big-end is to be. This hole should be the largest possible, whilst leaving sufficient strength in the shaft, and should preferably be finished with a small boring-bar. The shaft is then mounted on a mandrel in this hole and the material between the webs turned away to form the big-end. A firmer location of the shaft for drilling out the big-end is obtained by using a wider bar with a vertical slot wide and deep enough to take the crank webs, on the lines of a forked big-end bearing.

Some of the advantages of this method of machining are :—

(1) Throw of crank does not depend upon accuracy of marking-out and can be within 0.001 in. of designed figure without difficulty.
(2) Crank axis and shaft axis are automatically parallel.
(3) Crank-pin can at any time be re-turned to correct for wear.
(4) Greater rigidity of shaft when turning crank-pin, minimising liability of tool to dig in.

If forced oil feed to the big-end is to be used, it will, of course, be necessary to plug the ends of the hole through the big-end.

Yours faithfully,

Stafford. H. S. CHIRNSIDE.

The " Syrian Prince "

DEAR SIR,—I am afraid the Rev. Cartmel, in his description of the model of the *Syrian Prince*, has erred in stating it was made to one-eighth scale, as this would give the ship a length of 900 ft. instead of 331 ft., as per Lloyd's Register. It is an interesting model in a nice size to build.

Yours faithfully,

Polegate. FRANK J. CHRIMES.

Compound Steam Traction Engines

DEAR SIR,—I was delighted to read Mr. J. H. McDowell's letter in your issue dated April 18th, concerning these very interesting and most reliable engines. I hope the following notes will prove of interest to your readers.

The features which your correspondent refers to as unusual were, in fact, a special product of the manufacturers—Messrs. Charles Burrell & Sons Ltd., of Thetford, Norfolk. They went out of business several years ago, and I believe their business was taken over by Garrett's, of Leiston.

I am the fortunate possessor of a "Burrell" catalogue dated 1915 in which they made a special point of their "patent compound engines." They said that their single-crank system of compounds in which two pistons were attached to one crosshead was introduced in 1889 and up to 1915 about 1,000 of the type had been built, so that the driver of the Shropshire engine was obviously incorrect when he said that only five or six had been made.

Burrell's claimed that this system had the great merit of providing the advantages of "compounding," but at the same time obviating one of the principal disadvantages so far as it applied to traction engines: namely, the limited space available for bearing surfaces at the crankshaft end of the engine. The type employed one crank and two eccentrics only as against two cranks and four eccentrics in the case of the usual compound.

I have seen several Burrell traction engines and road rollers at various times incorporating the system and have always understood that they were most reliable and successful—the very fact that many of them still survive proves that. Long may they continue to delight those who are interested and to advertise British engineering craftsmanship at its best. Many of the engines were exported in pre-1914 days.

The auxiliary high-pressure lever was a prominent trait, and possessed a brass knob reminiscent of the old-fashioned brass door-knob.

If the stroke were 10 in. then the cylinders would probably possess a diameter of about 5¼ in. and 8½ in. (or 9 in.) respectively, giving a nominal h.p. of five (effective maximum constant load h.p. about nineteen). The revolutions per minute (governing) would be about 150/170. Most compound traction engines worked to a pressure of about 160/180 lb.

Burrell's made a special feature of "showmen's engines," though I believe most of these were built with double cranks, though I do remember seeing one with a single crank. I often see one of the double-crank engines at work in the Bristol area. It is kept in splendid condition, and is not only a delight to the eye, but a real exhibition of splendid craftsmanship.

May I say how much I look forward to and enjoy THE MODEL ENGINEER each week? I wish you the utmost success in your venture.

Yours faithfully,

J. P. EDWARDS.

Clubs

Society of Model and Experimental Engineers

At the last meeting there were present ninety-seven members and visitors to hear a description of the lathe built by Mr. E. W. Brennand. This lathe was on view and the design and workmanship were much admired.

The next meeting will be held at 39, Victoria Street, Westminster, S.W.1, on Saturday, June 15th, at 2.30 p.m., when Mr. F. S. Lovick-Johnson, M.I.Loco.E., will give a talk on the "Merchant Navy" class locomotive. This talk will be illustrated by slides and cinema film.

There will be a rummage sale at the workshop on Saturday, June 22nd, commencing at 2.30 p.m.

Will all members please note new address of the treasurer, viz.: Mr. A. J. Lamb, 46, Heworth Green, York.

Full particulars of the Society's activities can be obtained from the Secretary: J. J. PACEY, 69, Chandos Avenue, Whetstone, N.20.

Glasgow Society of Model Engineers

The next meeting will be held on Saturday, June 15th, 1946, at 3 p.m., jointly with visiting model engineers from other clubs in Scotland, with a common venue at Maxwell Park pond, Glasgow, S.W.1. The event will be an "all power-boat day," and boats of all types, both visiting and home, will be welcomed. Arrangements for tea are being made and the events will be looked forward to keenly as the first post-war power-boat show organised by the Glasgow society.

It is hoped to be established within the new clubrooms at 60, Clarendon Street, Glasgow, N.W., by this date, and the change should be noted. Visitors will be welcomed there on the joint day, if sufficient interest is shown.

Secretary: JOHN W. SMITH, 785, Dumbarton Road, Glasgow, W.1.

The Tyneside Society of Model and Experimental Engineers

The first of the new "feature programmes," given by the railways section, at the workshop, on Wednesday, May 8th, was a great success and a credit to Mr. H. Beavis and the railway enthusiasts of the society.

The next meeting at the workshop, Manors North Station, Newcastle-on-Tyne, will be held on Saturday, June 22nd, at 2.45 p.m.; lecture, "Proposed Hydroplane Design," by John Houstoun.

Hon. Secretary: S. G. JONES, 56, Moor Crescent, Gosforth, Newcastle-upon-Tyne.

The Bristol Society of Model and Experimental Engineers

On Thursday, May 23rd, a rummage sale was held at our usual meeting place, St. Nicholas' Parish Hall, Trinity Place, off Trinity Street, and was well attended by members.

Hon. Secretary: C. C. LUCY, 28, Bibury Crescent, Henleaze, Bristol.

Harrow Society of Model Engineers

An excellent ciné show was given to members of the above society by Mr. W. Banwell, at the Scout Room, Kenton, on May 8th.

Films shown were :—" From Dreams to Reality," dealing with the inception and construction of the " Maybank Railway," a popular pre-war feature at the Model Railways Clubs' Exhibition, at the Central Hall, Westminster. " The Four Ways," dealing with a series of train journeys, east, west, north and south, showing many interesting features on the way, and at its destination. " Accidents will Happen," a comedy film introducing Bill and Apples, camping companions who courageously attempted to avert a catastrophe which could not happen. " Foreign Lands," a coloured film of great interest, based on one of R. L. Stevenson's children's poems. Finally, " Folly and Fortune," a comedy romance with railway interest.

All these films were produced by Mr. Banwell and his friend Mr. Applegate, and were greatly appreciated by the audience.

Acting Secretary : A. D. POLE, 13, Churchfield Close, Woodberry Avenue, North Harrow.

South London Model Engineering Society

The next meeting will be held on Sunday, June 16th, at 11 a.m., at Kings College Sports Ground, Dog Kennel Hill, East Dulwich, when Mr. E. T. Rowland will give a talk on " Building a Model Steam Engine."

On Saturday, June 22nd, the society will operate its miniature passenger-carrying railway at St. Lawrence's Church, Catford, in aid of the church restoration fund.

Full particulars of membership can be obtained from Hon. Secretary : W. R. COOK, 103, Engleheart Road, Catford, S.E.6.

Burnley and District Society of Model Engineers.

The next meeting will be held at the Church Institute, Manchester Road, Burnley, on Friday, June 14th at 7.30 p.m.

Do not forget the Exhibition of Thursday, 20th at 6.30, Friday, 21st, 6.0 p.m. until 10.0 p.m. and Saturday, 22nd, 9.0 a.m. till 10.0 p.m.

Joint Hon. Secretaries : J. D. MEE, 2, Windsor Avenue, Church, Nr. Accrington and A. BATEY, 36, Moseley Road, Burnley.

Sutton Model Engineering Club Ltd.

The annual general meeting was held at the Garden Hall, Sutton, on May 11th, 1946.

The retiring chairman briefly addressed the meeting, after which the hon. treasurer presented the balance sheet for the past year. Income over expenditure showed a substantial balance on the right side, while the auditors to the company considered the financial position of the club was entirely satisfactory. The balance sheet, as presented, was agreed to.

Election of chairman, officers, and committee then took place. Mr. W. Savage was elected chairman for the ensuing year.

After taking office, the chairman said he wished to address the many and not the few ; merely paying a subscription was not enough, each individual should take an active and personal interest in what was going forward ; if they did that a progressive and successful club was a certainty, but not otherwise.

The committee have decided in future to devote one weekly evening per month chiefly to internal combustion matters ; the date fixed is the third Thursday in each month, at 9, Stanley Road, Sutton, at 8 p.m.

Other engagements permitting, Mr. Edgar T. Westbury kindly promised to be present and take charge on these occasions.

Hon. Secretary : P. G. JOHNSTON, 9, Stanley Road, Sutton, Surrey.

Cambridge and District Model Engineering Society

On May 1st, a visit was paid to the Cambridge and County Folk Museum, and was thoroughly enjoyed by a party of fifteen of our members.

Our fourth meeting was held in St. Andrew's Baptist Hall, on May 15th, when Mr. R. C. Lambeth gave a talk, illustrated by lantern slides, on " Early Agricultural Engineering." This was a great success, and credit is due to the speaker for the way in which he handled this interesting subject. The small show of models in course of construction created friendly discussion.

Hon. Secretary : E. WRIGHT, 111, Newmarket Road, Cambridge.

The Grimsby and District Society of Model and Experimental Engineers

The society held a regatta of miniature craft at the Sidney Park Lake, on Saturday, May 18th, which attracted an interested crowd of spectators. This was our first out-door meeting since the war, and enthusiasm was high. All types of ships were represented, including a steam-driven " Queen Mary," as well as various cruisers and yachts ; but a model paddle-steamer excited general comment, and was the star of the show. There were numerous enquiries from potential members, and altogether it was a most successful session.

Hon. Secretary : HUGH FITZPATRICK, 9, Abbey Road, Grimsby.

Mansfield and District Model Engineering and Handicrafts Society

Mr. Palmer, who is a boilersmith by trade, gave a demonstration of flanging boiler plates and shaping formers for these, for the Midge engines under construction, at the weekly meeting of the above society at their Bown Street workshop, Sutton-in-Ashfield. For particulars of membership apply to : Hon. Secretary : J. CORBETT, (Lathes), Stanton Hill, near Mansfield, Tel. : 583, Sutton-in-Ashfield.

NOTICES

The Editor invites correspondence and original contributions on all small power engineering and electrical subjects, which should be addressed to him at 23 Great Queen Street, London, W.C.2. Matter intended for publication should be clearly written, and should invariably bear the senders' name and address.

Readers desiring to see the Editor personally can only do so by making an appointment in advance.

All correspondence relating to sales of the paper and books to be addressed to THE SALES MANAGER, Percival Marshall and Co. Ltd., 23, Great Queen Street, London, W.C.2.

Correspondence relating to display advertisements to be addressed to THE ADVERTISEMENT MANAGER, " The Model Engineer," 23, Great Queen Street, London, W.C.2.

"THE MODEL ENGINEER"
SALES AND WANTS

Private: **Threepence** *word.* *Trade*: **Sixpence** *word.* *Use of Box* **2/6** *extra.*
Minimum charge, **3/-**

TOOLS & WORKSHOP

Buck and Ryan's Department for Lathes, Drilling Machines, Grinders, Electric Tools, Chucks, Surface Plates, Lathe Accessories and Tools.—310-312, Euston Road, London, N.W.1. Telephone: EUSton 4661. Hours of Business: 8.30 to 5.0 p.m., Monday to Friday; Saturday, 1.0 p.m.

Split Chucks for Watchmakers' Lathes, 6 mm., 6½ mm., and 8 mm., at 7s. each, postage 6d.—JOHN MORRIS, 64, Clerkenwell Road, London, E.C.1.

"Tool News" keeps you up-to-date. Specimen copy 6d., post free.—GARNERS, Sheffield Road, Barnsley.

Wood Workers. Send S.A.E. for details of our new W.T. Lathe.—GARNERS, Sheffield Road, Barnsley.

In Stock "Burnerd" 3-Jaw Chucks, 2½" diameter, self-centring at 78s. 9d.; 3" Lever Scroll at 63s.; 4" self-centring at £4 17s. 6d.; 4" Independent at £2; 6" Independent at £3 17s. 6d.; "Westcott," 3" self-centring at £12 12s. 6d.; "Cushman" 5" self-centring at £15. These prices include postage and packing. Send orders to—THE ACORN MACHINE TOOL CO. (1936) LTD., 610, 612, and 614, High Road, Chiswick, W.4. Telephone No.: Chis 3416.

Atlas Lathe Spare Parts and Accessories in stock, or very early delivery. Send for price lists to—THE ACORN MACHINE TOOL CO. (1936) LTD., 610, 612, and 614, High Road, Chiswick, W.4. Telephone No.: Chis 3416.

Myford M.L. 3½" S.C. Lathe, 24" between centres, countershaft, accessories, many improvements, little used. Best offer over £25. Can be seen by appointment.—N. A. OLDHAM, 147, Goodmayes Lane, Ilford, Essex. Tel.: Seven Kings 1175.

Wanted, Lathe Bed and various parts for a South Bend 9" Swing Lathe.—CROSSLEY, 65, Clayton Street, Colne, Lancs.

Senior No. O Bench-type Miller, automatic and hand feed, 1" and ½" arbors, countershaft with two-step driving pulley. First-class condition.—HEARN, 139, Rickmansworth Road, Watford.

Wanted for 5" Lathe, Top-slide, Faceplate, Change Wheels, Independent Chuck.—LANE, 51, Talbot Road, Port Talbot.

Copper Tubes, ¼ × 20 g., 1s. 3d.; 7/16 × 22 g., 8d.; ⅜ × 24 g., 7d., prices per ft. Thin walled in 4 ft. lots, 3/32, ⅛, 5/32, 3/16 diameters, 1s. 9d. each size; Brass beading, 1/16, 20 ft. lots, 1s. 9d. each; Stainless 1/16 steel handrail wire, 20 ft. lots, 3s. 6d. each; Brass angle, ¼ × 1/16, 4d. ft. Postage extra. Trade inquiries invited.—EVERSLEIGH, Trentham Road, Stoke-on-Trent.

Join the Throng of Satisfied Customers. Steel and Brass hexagon full nuts, 4, 5, 6, 3s. gross; 7, 3s. 6d.; 8, 4s.; 9-10, 4s. 6d.; Brass, 4, 5, 6, 2s. 3d.; 7, 8, 10, 2s. 6d.; Cheese and countersunk screws, 4, 5, 6, 7, 8 B.A., length ⅜-½", 2s.; ⅝-1" 2s. 6d.; Ioba brass, ⅜-½", 2s. 6d. gross; Steel, 4s. 6d., 5s. gross; Lodge Sparking Plugs, ⅜-24 t.p.i., 5s.; Iron rivets, 1/16, 3/32-⅛ × ⅜, 6d. gross; Copper and M/S rivets, large selection; Brass Sheets, 20 g., 3s. 6d. sq. ft.; "Hielan' Lassie" Castings: Hornblocks, 1s. 6d.; Eccentric Straps, 1s., 1s. 6d.; 40 t.p.i. Taps, 1s. 6d. each; Dies, 2s. 6d. each; Rustless Balls, Steel Brass Angles, Rods, Hex. Flats, White Metal, Bronze Wire, Silver Solders. Full lists and samples from—REEVES, 81, Cole Valley Road, Birmingham 28.

Wanted, Lathe, 3" or 3½", Screwcutting or otherwise.—21, McCallum Avenue, Rutherglen.

Drummond Lathe, 3½" Flat bed, as new, £38: Champion Bench Drill, £5 10s.; Denbigh Milling Machine Table, 18" × 4", £25.—C. MAY, 9, Camden Mews, London, N.W.1. 'Phone Gulliver 4330.

M.E. Taps and Dies, Case sets, ⅛"-¼" × 1/32" (40 t.p.i.), 38s.; ditto, plus 5/16", ⅜" × 32 t.p.i., 65s.; also separate sizes. Approval. Send stamp latest stock lists.—TERRY'S, Fishers Lane, Cold Ash, Newbury.

Sale, 3½" Myford B.G.S.C. Lathe, hand scraped bed, V belt throughout, bench countershaft unit, vertical slide, chuck, machine vice, tailstock chuck, tools and holders, etc, hardly used, with pair heavy cast stand or bench legs. £32; 1-230 volt single phase Motor, £4 10s.—9, Burberry Close, New Malden, Surrey.

Wanted, 3½" S.C.B.G. rack and pinion operated saddle lathe, compound slide rest preferable, price not more than £10, C.O.D.—W. WALKER, 14, Belsize Road, Harrow Weald, Harrow, Mdx.

3½" Late 1940 Model Drummond Lathe, complete with stand, one-third h.p. single phase motor and countershaft. What offers?—ALLSOP'S (ENGINEERS) LTD., Halfway Green, Walton-on-Thames.

MODELS & FITTINGS

Apex and New Atom Minor (Mr. Westbury's design). Engine castings of DTD 424, the famous alloy as used in Rolls Royce Aero engines, Sp. gr. 2.56. Tensile 9 tons, Lighter and far stronger than die cast, with most attractive finish. Carburettor castings (described June 14th issue "M.E."), and spiral timing gears for Apex; Ball-races, piston rings, miniature plugs, contacts and other equipment. Send us your enquiries. Trade also invited.—THE HEADINGLEY MOTOR & ENGINEERING CO. LTD., 8, Otley Road, Leeds.

Castings Machined Wheels, delivery stock, large range to 7¼" gauge. Cheapest in trade. Non-ferrous and iron castings to clients' patterns. S.A.E. list.—UNION FOUNDRY, Union Lane, Brixham, Devon.

Sale, 2½" Gauge Locomotive, nearly finished, 5" gauge frames, valve gear, con.-rods, bogies, eccentrics, blueprints, extras. Stamp, photo, particulars, offers.—MACK, 3, Paradise Street, Blackburn.

Pair Finished "Molly" Cylinders. Engineer made. Beautiful job, £5 10s.—KNOX, 14, Hutt Street, Hull.

Flexible Grinder, Morris flex. three speeds ¾ h.p., 400 v. A.C. Motor, in sound working condition, £10. No grinding wheels attached; one h.p. 4-stroke American Petrol Engine, flywheel, ignition, complete tank carb., etc., in running order, £6; 4 ton Jack, Oil, sound order, £2; include carriage for above.—25, Haugh Lane, Wombwell.

30-in. Hydroplane, fitted with 15-c.c. Atom Minor, coil and accumulator, ready to run, £15.—218, Crescent Drive, Petts Wood, Kent.

For Sale, "Molly Stanier," 3½" gauge 0-6-0 Tank Locomotive, £40.—Box No. 4021, MODEL ENGINEER Offices.

Well Made Horizontal Steam Engine, 4" stroke, 11" flywheel; also Dynamo. Offers.—HEATH, 214, Lake Road East, Cardiff.

Wanted, Gauge "O" Steam Locomotive and Rolling Stock; also small Bench Miller.—165, Tenniswood Road, Enfield, Middx.

ELECTRICAL EQUIPMENT

Electradix Bargains include:—

Dynamo and Motor Generator Bargains. G.E.C. double current Dynamos, 6 volts, 5 amps., 600 volts, 80 m.a., ball-bearings, 17 lb., as new, 37s. 6d., carriage paid, 5s. refunded on returned packing case.—Below.

Small D.C./D.C. Motor Generators by leading makers for use in Radio Receivers to take the place of H.T. battery, 6 volts input, 110 volts, 15 m.a. output, or 12 volts input, 230 volts, 30 m.a. output, £3 15s., weight only 5½ lb., size 5½" × 3½" × 3½", model finish, ball bearings, 2-comms., 2 separate windings, waterproofed.—Below.

Transformers, 3 K.W. Crypto, 230 volts to 115 volts, 28 amps., £9 10s.; to small Bell Transformers, 230/3/58 volts, 7s. 6d. Transformers for Rewind, 3 K.W. with stampings, 4½" × 6" × 7½", windings damaged by blitz, weight with damaged wire, 65 lb., 45s., carriage extra.—ELECTRADIX, 214, Queenstown Road, London, S.W.8.

D.C. Motors, ¼ h.p., 200/250 volts, £6 18s. each; ½ h.p., £3 15s. each. Many others.—JOHNSON ENGINEERING, 319, Kennington Road, S.E.11. RELiance 1412/3.

Electric Motors "Pigmy," 1/50th h.p. Ideal for models, 2¼" × 2" × 1¾", 10 ozs., 4/24 volts, A.C./D.C., Flashlamp Batteries, Transformers. Send 25s. 7d.—EDUCATIONAL MANUFACTURING COMPANY, 197, Brownshill Green Road, Coventry.

Westinghouse Dynamo, 110 volt, 30 amps., £18 18s. Charging plants. State requirements. — "UNIVERSAL," Southgate, Broadway, Derby.

Taylor Signal Generator, £12; several 0-1 milliammeters, £2 each.—HOPEWELL, 45, Coleby Road, Broxtowe, Nottingham.

GENERAL

Watch and Clock Making. If interested you can get all tools and parts, also wheels cut from—JOHN MORRIS, 64, Clerkenwell Road, E.C.1. Regret no posts or lists, only counter service at present.

Watchmakers Demobbed need Lathes to start work again. John Morris (Clerkenwell) Ltd., will pay high prices for Lathes by Lorch, Boley, Wolf Jahn, and American and Swiss makes.—64, Clerkenwell Road, E.C.1. CLE 6077.

Toymaker's Super Casting Mould for Lead Toys. Over 200 latest designs. Fully illustrated catalogue, 6d. Postal Order with large stamped addressed envelope.—AGASEE, 7, Stradbroke Road, Highbury Barn, London, N.5.

Monomarks. Permanent London Address. Letters redirected. Confidential, 5s. p.a. Royal patronage. Write—MONOMARK, BM/MONO6, W.C.1.

Precision Fitting, Turning, Motor repairs carried out by Ex Naval Engineers. Quotation against drawing. S.A.E.—ELECTRO ENGINEERING, 3 Bungalow, Baldry Gardens, Streatham, S.W.16.

Car Thermometers pre-war (Smiths) dash reading, flush fitting, matching other dash instruments. The most useful car instrument. Reading 90-212 Fahrenheit, 35s., new and complete.—TEDDINGTON ENG. CO., 29, High Street, Teddington, Middlesex.

For Sale, Pathe Baby Cine Camera with Camo motor attached, £10.—Box No. 4019, MODEL ENGINEER Offices.

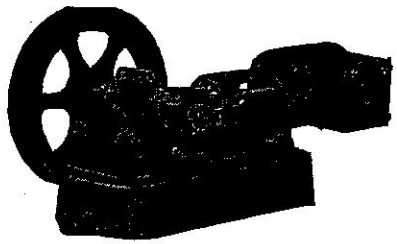
Sale, 12 Watt Amplifier Chassis and Speaker, 230 A.C., £12.—Box No. 4020, MODEL ENGINEER Offices.

"Model Engineers," Vols. 87 to 93, 4 copies missing, unbound, new, 84s. nearest.—7, Woodsley Road, Leeds 3.

Draughtsman, Experienced small mechanical and electrical mechanisms. Offers services for spare time work.—Box No. 4023, MODEL ENGINEER Offices.

STUART

MODELS, CASTINGS and MATERIALS



Stuart No. 10 Steam Engine

We are sorry we cannot yet supply. Although hostilities are at an end we still have many commitments with the Government which fully occupy the Model shop, not to mention that most important department—The Foundry.

We will advertise here when supplies are available.

STUART TURNER LTD.

HENLEY-ON-THAMES

SANGAMO SYNCHRONOUS MOTORS

Self-starting, exceptionally good torque ; rotor speed, 200 r.p.m., 200-250 V. a.c., 50 c. Consumption, 2½ watts. Size, 2⅝ in. × 2 in. Geared 1 rev. 60 min., can be reset to zero by friction drive from front or back. Shaft, ⅛ in. × 1/10 in., to run clockwise ; ideal movements for making electric clocks, time switches, etc. Nickel-plated finish. Price **22/6** each.
12 to 1 Dial Trains to fit above spindle, per set **2/6**.

CHAMBERLAIN & HOOKHAM SYNCHRONOUS MOTORS

Enclosed type, self-starting, exceptionally good torque ; rotor speed, 200 r.p.m., 200-250 V. a.c., 50 c. Consumption, 3 watts. Size, 2⅝ in. × 2 in. Geared 1 rev. 60 min., can be reset to zero by friction drive from front or back. Shaft, ⅛ in. × 1/10 in., to run clockwise ; ideal movements for making electric clocks, time-switches, etc. Nickel-plated finish. Price **25/-** each.
12 to 1 Dial Trains to fit above spindle, per set **2/6**.

15-AMP. MERCURY SWITCHES, enclosed bakelite tubular cases, 2½ in. × ⅝ in., fitted swivel saddle, connector block, etc., **5/6** each.

WIRE-WOUND NON-INDUCTIVE RESISTANCES, 2 watt ; ideal for meter shunts, resistance boxes, etc., 2½ per cent. accuracy, wound on bakelite bobbins, ½ in. × ½ in. One of each of the following ratings, 25, 50, 100, 200, 400, 600, 1,000 and 2,000 ohms, **5/6** per lot, postage paid ; quantities available.

ELECTRO MAGNETS, 200-250 V. a.c., resistance 320 ohms, 1⅝ in × 1¼ in., **3/6** each.

MOVING COIL HEADPHONES, P.M., energised by Alni magnets, 45 ohms, ½-in. coil. Ideal for mikes, miniature loud-speakers, etc. ; 1½ in. overall, in bakelite cases, with 3-in. front flange, **7/6** each.

MOVING COIL MICROPHONES, fitted as hand mic., with switch in handle, 45 ohms speech coil, **12/6** each.

THROAT MICROPHONES, fitted with elastic bands, 'phone, plug, 15 ohms speech coils, etc., **7/6** each.

RESPIRATOR CARBON MICROPHONES, fitted 'phone plug, lead, etc., **5/6** each.

CASH WITH ORDER. POST PAID ON ALL ABOVE GOODS.

TO CALLERS ONLY.—A comprehensive stock of scientific instruments, meters, gears, relays, etc.

H. FRANKS, Scientific Stores,
58, New Oxford Street, W.C.1.
'Phone : MUS. 9594.

LAL

Our Facilities cover every field of Electro-Mechanical Research and Development.

We welcome the unusual job, from the single gear or coil, to complete apparatus of the greatest refinement and complexity.

LYDIATE ASH LABORATORIES
Near BROMSGROVE, Worcestershire.

ENGINEERING

OPPORTUNITIES

This unique handbook shows the easy way to secure A.M.I.Mech.E., A.M.Brit.I.R.E., A.M.I.E.E., A.M.I.A.E., etc.

WE GUARANTEE
"NO PASS—NO FEE"

Details are given of over 150 Diploma Courses in all branches of **Civil, Mechanical, Electrical, Automobile, Aeronautical, Radio, Television and Production Engineering, Tracing, Building, Draughtsmanship, Govt. Employment, R.A.F. Maths, Matriculation,** etc.
Think of the future and send for your copy at once—**FREE**

B.I.E.T., 13A, SHAKESPEARE HOUSE,
17, Stratford Place, London, W.1.

You'll Be Glad

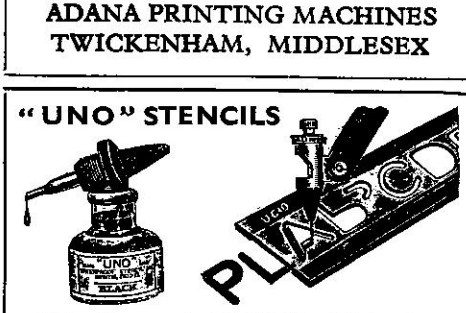
YOU KEPT ON SAVING

When You Can Again Buy An

ADANA

ADANA PRINTING MACHINES
TWICKENHAM, MIDDLESEX

"UNO" STENCILS

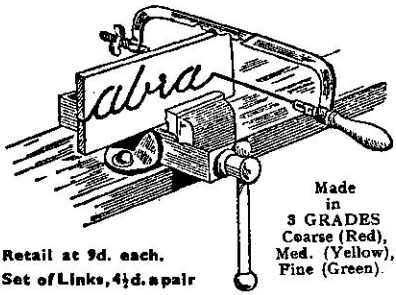


"UNO" WATERPROOF INK

FOR LETTERING PLANS & TRACINGS

Send for illustrated catalogue.

A. WEST & PARTNERS, LTD.,
36, Broadway, Westminster, London, S.W.1



Made in 3 GRADES Coarse (Red), Med. (Yellow), Fine (Green).

Retail at 9d. each.
Set of Links, 4½d. a pair

Special frames fitted with 8" "Abrafile" now available. 3" depth, 5/-; 4" & 5" depth, 5/3.

"ABRAFILE"

(Regd. Trade Mark)

THE *ORIGINAL* TENSION FILE

Thousands of craftsmen and keen metal workers are using "Abrafile" tension files for speeding and simplifying their metal work. One of the reasons is that with "Abrafile" there is no need to turn the work when altering the cutting direction. Just apply pressure in the new direction. And "Abrafile" tension files do not clog, even when used on softer metal.

Obtainable at all Ironmongers, Hardware Stores, etc., etc.

HOW TO USE "ABRAFILE" TENSION FILES

Take an ordinary hacksaw frame, slip in a set of links, one into each end, and insert the "Abrafile" Tension File. Tighten the tension in the usual way—and start on your cutting. You will be pleased with the results.

ABRASIVE TOOLS LTD.

Egyptian House, 170/173, Piccadilly, London, W.1. *Regent* 4416 (3 *lines*)

PERCIVAL MARSHALL'S

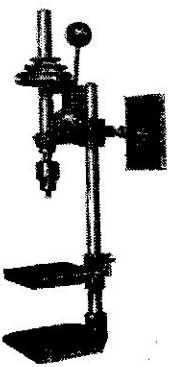
BLUE PRINTS for MODELLERS

Workshop Equipment
Ships & Boats
Petrol Engines
Locomotives
Aircraft

Write for full list to:

PERCIVAL MARSHALL & Co. Ltd.
23 GT. QUEEN ST., W.C.2

ACCURATE—STURDY
0-¼ in. SENSITIVE DRILL



A high-grade tool produced specially for Model Makers. Machined from the finest castings to close limits, ensuring accuracy. Single or 3-speed head, with spindle running in bronze bush at top. Graduated collar. Lock provided for spindle. Ball thrust. Head and drilling table adjustable on column. Motor plate with belt adjustment. Protected spring return to ball handle.

Price **£7 10s.**, as shown.
(Carriage and packing 2/6)

Drill with Motor and Pulley complete **£11 10s.**
(Both plus 7½%)

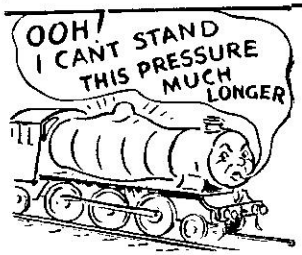
MYFORD STOCKISTS

Large range of materials and small tools. Your enquiries will receive our prompt attention.

CASTINGS for ⅝-in. × ⅝-in. Marine Engine in Gunmetal. Price **13 6**, including Blueprint. (Post 6d.)

CASTINGS for ⅞-in. × ⅞-in. D.A. Oscillating Engine (Gunmetal). Price **4 -**, including Blueprint. (Post 4d.)

R. BALLANTINE, LTD.
103½, ST. VINCENT ST., GLASGOW, C.2.
(Central 5619) *Established over 40 years.*



HE used the wrong material.

YOU need not!

We can supply the right material for your specific needs.

GUNMETAL
STEEL
BRONZE
DURALUMIN
FIBRE
EBONITE, Etc.

RETAIL MATERIAL SUPPLIES
377, Milkwood Rd., HERNE HILL, LONDON, S.E.24. (Close to Station)

Send for List "M.E." 2d. post free.

HAVE YOU FOR SALE

Locomotives, Rolling Stock, Track, etc., etc., either Electric, Clockwork or Steam, in gauges "OO" to 15 in., or Working Models of any description? If so, please send us fullest particulars and price required.

DO YOU REQUIRE

Models in perfect condition of the above description? If so, please state EXACT requirements, enclosing stamp.

BOTTERILLS,
282, Albany Road, London, S.E.5.

A COMPLETE RANGE
MADE TO CONFORM TO
B.S.I. SPECIFICATIONS.
Nos. 870 and 959.
INTERNAL OR EXTERNAL TYPES.
English or Metric Graduations.

MOORE & WRIGHT (SHEFFIELD) Ltd., SHEFFIELD, ENG.

We send our best wishes to all our Model Making friends with the hope that our past good relations can now be resumed.

There are still supply difficulties, such as shortage of suitable labour, but we are doing our best to meet all demands.

BOND'S

We now have in stock a large assortment of

MOORE & WRIGHT TOOLS

Send us a list of what you require and we will be pleased to quote for same.

SPECIAL OFFERS

STAINLESS STEEL, Round, 1/16 in., 2½d. ; 3/32 in., 4d. ; ⅛ in. 6d. ; 5/32 in., 9d. ; 3/16 in., 10½d. ; ¼ in., 1s. 1d. ; 5/16 in., 1s. 9d. ; ⅜ in., 2s. 4d. ; ½ in., 3s. 4d. per foot.

STAINLESS STEEL BALLS, 1/16 in., 1s. ; 3/32 in., 8d. ; ⅛ in. 7d. ; 5/32 in., 7d. ; 3/16 in., 8d. ; 7/32 in., 8d. ; ¼ in., 11d. ; 5/16 in., 1s. 4d., ⅜ in., 2s. 4d. doz.

BALL RACES, ¼ in. bore by ⅜ in., O.D., 2s. 8d. each.

5-STEP VEE PULLEY, for ¼ in. belt, ¼ in. bore, 5/16 in. O.D.-1⅜ in. diam., 6s. 6d. each.

NICKEL SILVER SHEET, 12 in. wide × 28 s.w.g., 4s. per ft. ; 12 in. wide × 24 s.w.g., 5s. per ft.

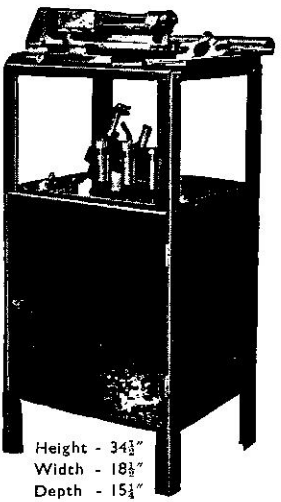
G. "O" STEEL RAIL in 3ft. lengths, 2/9 per doz. ⅛ in. **SCALE STEEL RAIL,** suitable for keyed chairs only, while stocks last, 7s. per doz. yds.

All prices plus packing and carriage.

BOND'S O' EUSTON ROAD, LTD.
357 Euston Road, London, N.W.1.
Established 1887. *'Phone :* EUSton 5441-2.

STRONG, METAL CABINETS . . .

Built to withstand hard usage, fitted lock and key and beautifully enamelled in green, these E.H.J. Tool Cabinets serve many uses and keep the workshop neat and tidy. They are a real quality job, proof against buckling and distortion.



Height - 34⅛"
Width - 18½"
Depth - 15¼"

63/- each

E. H. Jones (MACHINE TOOLS) LTD
Telegrams: 7CH
FOLEWARE ROAD • THE HYDE • LONDON • N.W.9

Printed in Great Britain for the Proprietors by Electrical Press, Ltd., Cordwallis Works, Maidenhead, Berks., and published by Percival Marshall & Co., Ltd., 23, Great Queen Street, London, W.C.2.